EPIDEMIC
CONTAGIOUS TRACHOMA

by

CARL FERDINAND VON GRAEFE, M.D.

Translated
From the German
by
Merle E. Frampton, Ph.D., LL.D., Litt.D.
Formerly Professor of Education, Teachers College,
Columbia University, New York City, New York
and
Director Emeritus, New York Institute for the Education of the Blind,
New York City, New York

and

Ellen Kerney, M.A.

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DEDICATION

To ALBERT J. ELIAS, successful in business, as an author and above all as one who has demonstrated through his own life, a devoted interest in the handicapped.

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EPIDEMIC CONTAGIOUS TRACHOMA

among the European troops in the War of Liberation: its origin, recognition, prevention, and treatment observed during the campaigns of 1813, 1814, and 1815.

By

Carl Ferdinand Graefe, M.D.[1]

Surgeon General of the Army of the King of Prussia;
Privy Councillor;
Co-Director of the Royal Military Academy of Medicine and Surgery, and of the Friedrich Wilhelm Institute;
Member of the scientific deputation in the Ministry of Ecclesiastic Affairs and Public Instruction;
Third-class Knight of the Order of the Red Eagle, Knight of the Iron Cross, and second-class Knight of the Imperial Russian Order of Saint Anna:
Officer of the Royal French Legion of Honor;
Knight of the Royal Swedish Order of Gustavus Wasa, and fourth-class Knight of the Imperial Russian Order of Saint Vladimir:
Official Professor ordinarius of Medicine and Surgery at the University of Berlin;
Director of the Royal Clinical Institute of Surgery and Ophthalmology of Berlin, of the Royal Society of the Medical Faculty of Paris, of the Society of Emulation of Paris, of the Royal Scientific Society of Gottingen, of the Imperial Russian Society of Natural History of Moscow, of the Society of Physics and Medicine of Erlangen, of the Society of Naturalists of Halle, of the Lower Rhine Therapeutic Society of Bonn, of the Grand Ducal Society of Natural Science of Heidelberg;
Member and Corresponding Member of other societies.

Illustration

Well reputed to cure eye diseases at Abu-Mandur, Egypt.

With five pages of copper-plate engravings.

Berlin. 1823.

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INTRODUCTION

In the twilight years of life one strives to complete unfinished business before the shades of night write the final word. The works of Carl Ferdinand Von Graefe, M.D. (1787-1840) distinguished surgeon of the early part of the 19th Century came to my attention early in the 20th Century. Trachoma, cholera and smallpox were for centuries the chief causes of blindness in the world. Von Graefe's treatise on Trachoma I secured in Europe and resolved to translate the volume, since its contents had some bearing on the field of professional service I had recently entered. The pressures of a busy administrative life made it impossible for me to give my undivided attention to the task. From time to time over a period of four decades I was able to spend some time on the translation. The work was by no means easy. To render the proper meaning in more or less understandable English from old medical German terms consumed many hours of careful planning and at times very tedious research. For a period of time I had the valuable aid of Dr. Bernard Samuels (1879-1959) distinguished ophthalmologist of Cornell University. Dr. Samuels aided in the difficult task of adapting German medical terms to their English counterparts, in so far as this was possible. Ellen Kerney re-read the translation several times for errata. Dr. Karen Newman and James Bickford spent many hours preparing the manuscript for publication. I owe these colleagues my deep gratitude for their work.

I have tried to rationalize some current practical value for printing this volume in this generation. The enormous store of scientific medical knowledge, advances in treatment and development of new technical equipment have long since left this text to the past. Therefore, I must satisfy myself that whatever contribution it is to make will be its historical value, since I can not discover any English translation. A further reason may be found in the translator's style of living, namely he dislikes leaving unfinished business.

MERLE E. FRAMPTON
Tucson, Arizona 1980

Dedicated, in all humility, to the august sovereigns who founded the happiness and peace of Europe, to the gracious protectors of the arts and sciences, to the everlasting welfare of their peoples, with the most profound respect and with the undying gratitude of the author:

His Majesty the Emperor of Russia and King of Poland, Alexander I.

His Majesty the King of Prussia, Friedrich Wilhelm III.

His Majesty the King of Great Britain, Ireland, and Hanover, George IV.

His Majesty the King of France and Navarre, Louis XVIII.

His Majesty the King of the Netherlands, William I.

His Majesty the King of Sweden and Norway, Charles XIV.

And Many Others.

Foreword.

The eye scourge of our time took a heavy toll among the armies as well as among the general masses, almost throughout Europe, indeed even in the New World. Thousands lost their sight, large hospitals were erected for eye patients and public institutions for the care of the blind, and considerable sums were expended to wipe out the epidemic. The pestilence did not die out in any one country or in any one spot; it broke out anew everywhere sporadically, and its recurrence is dreaded everywhere. - Consequently there is not doubt as to the importance of the subject.

Thanks to the wide range of labors imposed on me by His Majesty the King of Prussia and by the combined Commissariat of his noble allies during the War of Liberation (since I had charge of several field hospitals attached to the fighting section of the army, of the collective reserve medical establishments of the Prussian army, of the military hospitals in the Prussian provinces between the Vistula and the Rhine, and of all Prussian hospitals located in Holland and the Netherlands), within that space of time no important hygienic measure could escape my notice. According to the official figures over 100,000 patients were received into the above mentioned institutes, among whom were for the first time found an unusually large number of eye patients; consequently the latter attracted my attention at a very early date. I collected detailed information regarding these eye patients; during my travels I saw what form the affliction took in the north and south, how it appeared among the soldiers of the most widely differing European races, how methods of treatment of adherents gave rise to wholly opposite theories. When the disease increased during the campaign of 1815, I assembled the more serious cases (where the patients could be moved) at the central bureau of my work at the time, Saint Cecilia's Military Hospital, in Cologne, in order to undertake their immediate treatment, aided by Doctor Zitterland, the Physician-in-Chief to the King. In this connection that gifted and learned gentleman assumed the responsibility for not only the case histories as a whole (which were drawn up for each individual afflicted), but also the compilation of the reports, verifications, and illustrations, which are of greater value. All those circumstances - extremely favorable to accurate observation - enabled me: to have a true conception of the beginning, the fastigium, and the dying out of the epidemic; to observe the course of the disease in the manifold stages of its development, in its pure and composite forms, in its modifications due to external influences as well as to definite types of physique; and to obtain full particulars regarding the results in question.

My purpose in writing this book is to record in it now the results of my experience as well as the findings which I obtained in part from correspondence with several physicians of France, England, Italy, and Germany, in part from documents of Greek and Arabic medicine, with no small satisfaction. Only by pursuing such a course, by avoiding a hasty categorical decision based on isolated facts, by cautiously weighing the disease in its mildest and severest forms, in its original and subsequent relations, in its behavior among varied races, and by relating the part to the whole do we see the nature of the affection in a light which is of equal importance for the study of ophthalmia, for the laws of contagion, and for treatment.

With respect to the form of presentation, illustrated accounts of the individual reports and case histories would have filled several large volumes and thus (no less than from inevitable repetitions) made use of the work unusually difficult. Indeed, systematic compilation of the book during the small leisure remaining to me after performance of my public professional duties kept me from undertaking it for years, but was nevertheless absolutely to be preferred, in consideration of the weighty subject involved.

In accordance with this attitude, I felt that the most concise treatment would be to arrange the entire material in the following order. Book one was to describe the manifestations of the disease exclusively; they had to be kept separate from the accidental aspect, in order to serve as criteria proper of the anomaly, the chief object. In book two, relying on that fact, I aimed at a discussion of the nature of the affection, of its various characteristics, its composite forms, and diseases related to it. Accordingly, book three could deal merely with the history of ophthalmia from the era before the birth of Christ up to our times. I devoted book four to the etiology. In book five I took up the prevention and treatment. Book six I turned into supplements, which would have spoiled the continuity had they been placed elsewhere. - I shall feel richly rewarded for my laborious task if in presenting this book (the bulk of which has been ready for my readers since the year 1816) I succeed in shedding some light on the subject which until now has remained in darkness, and in discovering sounder principles for the cure of that disease.

Berlin, June, 1823.

Table of contents.

BOOK ONE. SYMPTOMATOLOGY.

Its purpose and scope. Article 1

Part one. Primary symptoms of the disease.

Chapter I. Signs of watering.

A general account of it. Article 2

Its relation to the secretion of serum. Article 3

Its relation to the texture of the palpebral conjunctive. Article 4

Its relation to sensation. Article 5

Its duration. Article 6

Illustration of watering. Article 7

Chapter II. Signs of discharge of mucus.

A general account of it. Article 8

Its relation to the secretion of mucus. Article 9

Its relation to the formation of the conjunctiva. Article 10

Its relation to sensation. Article 11

Its duration. Article 12

Chapter III. Signs of discharge of pus.

A general account of it. Article 13

Its relation to the secretion of pus. Article 14

Its relation to the texture of the conjunctiva in general. Article 15

a. Structural anomalies of palpebral pyorrhea in particular. Article 16

b. Structural anomalies of ocular pyorrhea in particular. Article 17

c. Influence of conjunctival disease on the outer lamellae of the eyelid. Article 18

d. Influence of conjunctival disease on the production of fungous eversions of the eyelid. Article 19

Its anomalies of sensation. Article 20

Its duration. Article 21

Illustrations of the discharge of pus.

a. As regards changes in the outer skin of the eyelid. Article 22

b. As regards changes in the palpebral conjunctiva. Article 23

Part two. Secondary symptoms of the disease.

Their relation to the primary disease in general. Article 24

Chapter I. Sequelae affecting the eyelids.

Their connection with the primary affection. Article 25

a. Subsequent loss of cohesion of the palpebral conjunctiva. Article 26

b. Sarcomatous ectropion. Article 27

c. Entropion. Article 28

d. Ptosis. Article 29

Chapter II. Sequelae affecting the ocular conjunctiva.

Their relation to the primary disease. Article 30

a. Ocular membranes. Article 31

b. Ulcerations of the scleral conjunctiva. Article 32

Chapter III. Sequelae affecting the cornea.

Connection between their occurrence and the primary disease. Article 33

a. Corneal opacities in general. Article 34

aa. Corneal opacities due to trachoma. Article 35

bb. Corneal opacities due to inflammation. Article 36

cc. Adynamic corneal opacities.
b. Corneal staphyloma in general. Article 38
aa. Extension staphyloma. Article 39
bb. Adhesion staphyloma. Article 40
c. Corneal ulcers in general. Article 41
aa. Corneal ulcers due to inflammation. Article 42
bb. Corneal ulcers due to resorption. Article 43
Chapter IV. Sequelae affecting the iris
Their relation to the primary disease. Article 44
a. Synechia of the iris. Article 45
b. Staphyloma of the iris. Article 46
c. Subsequent blennorrhea of the iris. Article 47
Chapter V. Sequelae affecting the lens and the vitreous.
Cataract and glaucoma in relation to their causation by the primary disease. Article 48
Chapter VI. Sequelae affecting the retina.
Relation of the retina to the primary disease. Article 49
a. Secondary photophobia. Article 50
b. Amaurosis. Article 51
Chapter VII. Sequelae affecting the central vascular system of the eye.
Hydrophthalmus and atrophia bulbi. Article 52

BOOK TWO. NOSOLOGY.

Its purpose and scope. Article 53
Chapter I. The nature of trachoma.
a. Inflammation as the basis of all vegetation anomalies; difference between pure and mixed. Article 54
b. Trachoma belongs among those mixed inflammations called blennorrheas. Article 55
c. Internal basis of the blennorrheas. Article 56
d. Site and extent of blennorrhea in general. Article 57
aa. Duration of blennorrhea in relation to the nature of the organs. Article 58
bb. Final metamorphosis which the blennorrheas cause in each structure. Article 59
e. Course of blennorrhea in the eye. Article 60
f. General status of the blennorrheal excretion. Article 61
aa. Its analogy with the secretion of pus. Article 62
bb. Its contagiousness in general. Article 63
α. Degree of contagion during watering. Article 64
β. Degree of contagion during the discharge of mucus. Article 65
γ. Degree of contagion during the discharge of pus. Article 66
αα. Proof that the purulent secretion acts by contact. Article 67
ββ. Proof that it produces contagion at a distance. Article 68
γγ. Proof that it is sometimes utterly devoid of contagiousness. Article 69
δδ. Properties which determine its inconstant or constant contagiousness, or total lack of contagiousness. Article 70

δ. Changes which external factors produce in the contagion of trachoma. Article 71
ε. Course of contagion in the epidemic spread of trachoma. Article 72
ζ. Relation of the contagion of trachoma to the contagion of epidemics of typhus fever. Article 73
g. Etymology. Article 74

Chapter II. Forms of trachoma.

General remarks on the forms. Article 75
a. The synochal form of logado-blennorrhea. Article 76
b. The erethitic form of logado-blennorrhea. Article 77
c. The torpid form of logado-blennorrhea. Article 78

Chapter III. Simple and composite forms of epidemic and contagious logado-blennorrhea.

a. Simple form of logado-blennorrhea. Article 79
b. Composite forms of logado-blennorrhea. Article 80
aa. Conjunctival blennorrhea complicated by diseases in other parts of the eye. Article 81
bb. Conjunctival blennorrhea complicated by extraocular diseases. Article 82
α. Conjunctival blennorrhea complicated by congestions of blood toward the head. Article 83
β. Trachoma complicated by fevers. Article 84
γ. Logado-blennorrhea complicated by exanthemata. Article 85
δ. Logado-blennorrhea complicated by abdominal diseases. Article 86
ε. Logado-blennorrhea complicated by dyserasia and cacochymia. Article 87
ζ. Logado-blennorrhea complicated by wounds and ulcers. Article 88

Chapter IV. Course of epidemic and contagious logado-blennorrhea.

a. Duration. Article 89
b. Type. Article 90
c. Stages:
aa. Stadium principii.
bb. Stadium incrementi.
cc. Stadium fastigii.
dd. Stadium decrementi.
ee. Stadium reconvalescentiae. Article 91

Chapter V. Diseases to which epidemic contagious logado-blennorrhea is related.

General relation of epidemic contagious logado-blennorrhea to sporadic blennorrheas. Article 92
Sporadic trachoma traced from its mildest form to its transition into the epidemic contagious form. Article 93
a. Sporadic blepharo-blennorrhea. Article 94
aa. Partial blepharo-blennorrheas. Article 95
α. Blepharo-blennorrhea of the canthus. Article 96
αα. Lemositas, lemia, lemae, lippitudo angularis. Article 97

ββ. Peribrosis, perivrasis. Article 98
β. Marginal blepharo-blennorrhea. Article 99
αα. Lippitudo simplex, lippitudo arida, lippitudo sicca, lippitudo crystallifera, epiphora sebacea, gramia, lippitudo senilis. Article 100
ββ. Lippitudo ulcerosa, inflammatio palpebrarum excoriatoria, lippitudo pruriginosa, psorophthalmia. Article 101
bb. Total blepharo-blennorrheas. Article 102
α. Ophthalmia serosa, ophthalmia humida, ophthalmia catarrhalis, ophthalmia sicca, sclerophthalmia, xerophthalmia, xerophthalmos. Article 103
β. Ophthalmia glandulosa, blepharophthalmia, blepharo-blennorrhea, ophthalmia glandulosa scrophulosa, ophthalmia glandulosa venerea, "trachoma", sycosis, dassymma, palpebra ficosa. Article 104
b. Sporadic ophthalmo-blennorrheas, oculus purulentus, chemosis blennorrhoica, ophthalmia neonatorum, ophthalmoblennorrhoea arthritica, blepharophthalmia glandulosa variolosa, blepharophthalmia gonorrhoica. Article 105

BOOK THREE. HISTORY.

Chapter I. Presence of epidemic contagious trachoma in the orient, the earliest date of its occurrence, and its persistence in Egypt down to the present century.

Proof of epidemic logado-blennorrhea prior to the Christian era.
a. Admirable description of the disease by Hippocrates, widely copied by later physicians. Article 106
Status of epidemic contagious logado-blennorrhea after the birth of Christ.
a. In the first and second centuries Celsus and Galen establish the views of Hippocrates; Celus transcribes them almost word for word; Galen notes particularly that the disease is highly contagious. Article 107
b. In the sixth and seventh centuries, although Aetius of Amida, Alexander of Tralles, and Paul of Aegina give evidence of the common occurrence of trachoma, they neglect to observe the disease accurately. Article 108
c. In the eleventh century Avicenna again goes back to Nature for a description of the disease, which he outlines in a masterly way. Article 109
d. In the sixteenth century Prospero Alpini makes a remarkable communication regarding the epidemic ocular blennorrhea prevailing in Egypt. Article 110

e. In the eighteenth and nineteenth centuries
Prospero Alpini's explanation of trachoma was confirmed by the Franco-English expedition into Egypt, which yielded further proof of the highly contagious nature of the disease. Article 111

Chapter II. History of epidemic trachoma among the French troops from 1798 to 1801, caused by the Egyptian campaign.
Attendant symptoms. Article 112
Course taken by the epidemic among the troops, exacerbation owing to different climatic changes, to sites of encampment, to changes of post, and to fatigue of the army. Frequency of the disease. Article 113
Epidemic practically wiped out by the return of the army to France, and disease not transmitted to the French race. Article 114

Chapter III. History of logado-blennorrhea among the British troops from 1801 to 1818, caused by the Egyptian campaign.
Form of the disease in Egypt. Article 115
Form of the disease in England and its communication to the British people. Article 116

Chapter IV. History of epidemic trachoma among the Italian army and race from 1801 to 1813, being introduced into Italy from Egypt.
Attendant symptoms. Circumstances favoring the spread of the disease. Article 117
Frequency of the disease. Article 118
Course of the epidemic. Article 119

Chapter V. History of epidemic trachoma among the troops of the Allies (in Germany, France, Holland, Belgium, Sweden, and Norway) from 1813 to 1815, Caused by the War of Liberation.
Attendant symptoms. Article 120
Different characteristics among different races. Article 121
Frequency of the disease. Article 122
Course of the epidemic in general. Article 123
Beginning of the epidemic in 1813. Article 124
Its increase in 1814. Article 125
Its peak and decrease in 1815. Article 126

Chapter VI. General conclusions.
Epidemic contagious trachoma prevailed long ago and manifested itself essentially in the same way in all places. Article 127
The disease may spread from one race to another by contagion. Article 128
The epidemic is always exacerbated by forced marches as well as by overcrowding of large numbers of persons. Article 129
The epidemic thrives on damp air, on a considerable and lasting change of temperature. Article 130
Influence of geography on development and continued existence of the epidemic. Article 131
Relation of the earlier epidemics of trachoma which appeared in Europe to the later epidemics. Presumable influence of polar changes on the migration of the more advanced stage of the disease from the orient to the occident. Article 132

BOOK FOUR. ETIOLOGY.

Chapter I. General consideration of the causes.
  Inadequacy of earlier investigations. Article 133
  Scope and purpose of the present ones. Article 134
Chapter II. Causes paving the way.
  A general discussion of them. Article 135
    a. Those which have rather a local action on the conjunctiva.
      aa. Glare. Article 136
      bb. Congestions of blood toward brain and eye. Article 137
      cc. Fine dust. Article 138
      dd. Close-cropped hair. Article 139
      ee. Predisposition of the right eye. Article 140
      ff. Ocular blennorrhea previously. Article 141
    b. Those which pave the way for ocular blennorrhea through systemic disease.
      aa. Delicate youths are more susceptible to illness. Article 142
      bb. The lower and poorer classes were more susceptible to blennorrhea. Article 143
      cc. Unfamiliarity with life at the front predisposes men to trachoma. Article 144
      dd. Individuals who had suffered from dyscrasia and cacochymia became particularly susceptible to blennorrhea. Article 145
Chapter III. The occasional causes.
  A general discussion of them. Article 146
  Conditions whose chief action is to produce hypersecretion in the conjunctiva.
    a. Causes which directly stimulate the conjunctiva to hypersecretion.
      aa. Concentrated animal effluvia. Article 147
      bb. Muriatic vapors in the air. Article 148
    b. Causes which indirectly produce hypersecretion in the eye through hyposecretion in other organs.
      aa. Decreased secretion in the lower half of the mucosae. Article 149
        α. Reduced intestinal secretion. Article 150
        β. Suppressed urethral secretion. Article 151
      bb. Hyposecretion in the outer skin caused by: Article 152
        α. Bivouacs. Article 153
        β. Improper clothing. Article 154
        γ. Sojourns in localities with an abundant water supply. Article 155
        δ. Autumn weather. Article 156
      cc. Hyposecretion in preternatural organs of secretion. Article 157
  The virus of contagion as the particular cause of trachoma.
  A general discussion of the virus of contagion as the cause of the disease. Article 158
  Its relations to the various epidemic forms of trachoma. Conditions which make the disease appear as purely endemic and as purely epidemic, and also as endemic and contagious and as

epidemic and contagious. Article 159

BOOK FIVE. TREATMENT.

Part one. Prognosis.
A general discussion of prognosis. Article 160
Chapter I. Relation between causes and prognosis.
- a. Definite recovery. Article 161
- b. Difficult recovery Article 162
- c. Rare recovery. Article 163
- d. Unavoidable loss of eye. Article 164

Chapter II. Relation between stages of development and prognosis.
- a. Easy cure. Article 165
- b. Difficult cure. Article 166
- c. Serious danger. Article 167
- d. Inevitable loss of eye. Article 168

Chapter III. Tendency toward definite sequelae in relation to prognosis.
- a. Circumstances which make secondary palpebral diseases feared. Article 169
  - aa. The imminence of subsequent loss of cohesion on the part of the palpebral conjunctiva.
  - bb. The imminence of sarcomatous ectropion.
  - cc. The imminence of entropion.
  - dd. The imminence of ptosis.
- b. Circumstances in which we fear secondary diseases of the bulbar conjunctiva. Article 170
  - aa. The imminence of ocular films.
  - bb. The imminence of ulcerations of the bulbar conjunctiva.
- c. Symptoms which make secondary corneal diseases feared. Article 171
  - aa. The imminence of corneal opacities.
  - bb. The imminence of corneal staphylomata.
  - cc. The imminence of corneal ulcers.
- d. Symptoms of secondary diseases of the iris. Article 172
  - aa. The imminence of synechias of the iris.
  - bb. The imminence of staphylomata of the iris.
  - cc. The imminence of blennorrhea of the iris.
- e. Conditions followed by secondary diseases of the lens and vitreous (cataract and glaucoma). Article 173
- f. Symptoms of secondary diseases of the retina. Article 174
  - aa. The imminence of secondary photophobia.
  - bb. The imminence of amaurosis.
- g. Conditions where we must fear sequelae in the central vascular system of the eye (hydrops or atrophia bulbi). Article 175

Part two. Prevention
General aspects. Article 176
Chapter I. Criteria for the selection of recruits.
Chapter II. Means of avoiding the causes of trachoma and of diminishing the force of the unavoidable causes.

a. Clothing of able-bodied soldiers as regards general health. Article 178
aa. Head covering. Article 179
bb. Uniforms. Article 180
b. Conservation of energy. Article 181
c. Cooling and cleansing of healthy eyes. Article 182
d. Measures for preventing infection. Article 183
aa. Prevention of contagion afield Article 184
bb. Prevention of contagion in hospitals by means of proper regulations. Article 185
α. Isolation of trachoma patients. Article 186
β. Keeping them far enough apart. Article 187
γ. Sanitation essential to prevent agent of contagion from gaining in virulence. Article 188
δ. Protection against spreading of the virus when convalescents are discharged. Article 189
Chapter III. How to check the latent disease early enough to ensure its destruction. Article 190
Chapter IV. Prevention of recurrences.
Importance of this point. Article 191
a. Unconditional discharge of all men in whom recurrences may not be prevented. Article 192
b. Conditions under which cured men are to be returned to active service. Article 193
c. Means of protecting cured men against recurrences during campaigns. Article 194
Part three. Treatment of logado-blennorrhea.
General consideration. Article 195
Section one. Treatment directed against the remote causes of trachoma.
Value of this practice. Article 196
Chapter I. Treatment directed against general causes.
a. Procedure on the battlefield. Article 197
b. Procedure in hospitals. Article 198
aa. Sick-room regulations. Article 199
bb. Regulations governing the use of eyeshades. Article 200
cc. Regulations governing the head covering eye patients. Article 201
dd. Regulations governing the footwear of eye patients. Article 202
ee. Regulations governing outdoor exercise. Article 203
ff. Regulations governing the temperature of the rooms. Article 204
gg. Regulations governing diet. Article 205
hh. Regulations governing the cleansing of eyes affected with blennorrhea. Article 206
Chapter II. Treatment directed against special causes.
a. Treatment of congestions toward the head. Article 207
aa. Procedure in mild congestion. Article 208
bb. Procedure in severe congestion. Article 209
b. Treatment of gastric complications. Article 210
c. Restoration of impaired secretions.
aa. Procedure in impaired secretion of the intestinal canal.

bb. Procedure in suppressed urethral secretion. Article 211
cc. Procedure when the secretion of the outer skin is disturbed. Article 212
dd. Treatment of suppressed secretion in secretory organs of anomalous origin. Article 213
d. Consideration of various dyscrasias accompanying trachoma. Article 214
Section two. Treatment based on the different forms of ocular blennorrhea.
General aspects of this treatment. Article 215
Chapter I. Treatment of the synochal form.
Criteria for prescribing it. Article 216
a. Remedies having a general action. Article 217
b. Remedies having a local action. Article 218
c. Diet and regimen. Article 219
Chapter II. Treatment of the erethistic form.
Criteria for applying it. Article 220
a. Medical and dietetic treatment when erethism tends toward synocha. Article 221
b. Medical and dietetic treatment when erethism lies midway between synocha and torpor. Article 222
c. Medical and dietetic treatment when erethism tends toward torpor. Article 223
Chapter III. Treatment of the torpid form.
Criteria for applying it. Article 224
a. Means having a general action. Article 225
b. Means having a local action. Article 226
c. Diet and regimen. Article 227
Section three. Treatment based on the degree of development of trachoma.
General aspects of this treatment.
a. We act directly to stop trachoma by means of oxygen compounds, preferably. Article 228
b. Difference in the oxygen content of drugs used to counteract trachoma. Article 229
c. Principles which we observe in employing means suitable to the various stages of development of trachoma. Article 230
d. Harmfulness of all procedures which promote loss of cohesion of the cellular tissue in the direct treatment of trachoma. Article 231
e. Direct treatment in relation to the other indications. Article 232
Chapter I. Direct treatment of watering.
Indications for its use. Article 233
a. Use of cold water. Article 234
b. Use of vegetable substances containing oxygen. Article 235
c. Use of solutions containing metallic salts alone. Article 236
Chapter II. Direct treatment of the discharge of mucus.
Indications for its use. Article 237
a. Use of red mercuric oxide. Article 238
b. Use of white mercuric ocide. Article 239
Chapter III. Direct treatment of the discharge of pus.

Criteria for prescribing it. Article 240
Treatment of palpebral pyorrhea.
  a. Use of black mercurous oxide. Article 241
  b. Use of comphorated metallic-salt collyria. Article 242
Treatment of ocular pyorrhea.
Its relation to the treatment of palpebral pyorrhea. Article 243
  a. Use of escharotics producing revulsion. Article 244
  b. Purpose of puncture of the cornea. Article 245
Section four. Treatment of the sequelae.
Scope of this account. Article 246
Chapter I. Treatment of palpebral sequelae.
  a. Treatment of secondary loss of cohesion of the palpebral conjunctiva. Article 247
  b. Treatment of sarcomatous ectropion.
  General aspects. Article 248
    aa. Use of red mercuric oxide ointment. Article 249
    bb. Use of silver nitrate. Article 250
    cc. Excision. Article 251
    dd. Use of the cautery iron. Article 252
  c. Treatment of entropion. Article 253
  d. Treatment of secondary ptosis. Article 254
Chapter II. Treatment of sequelae affecting the ocular conjunctiva.
  a. Treatment of ocular membranes. Article 255
  b. Treatment of ulcers forming in the ocular conjunctiva. Article 256
Chapter III. Treatment of corneal sequelae.
  a. Treatment of corneal opacifications.
  General aspects. Article 257
    aa. Procedure in blennorrheal opacifications of the cornea. Article 258
    bb. Procedure in inflammatory spots upon the cornea. Article 259
    cc. Procedure in adynamic opacifications of the cornea. Article 260
  b. Treatment of corneal staphyloma.
    aa. Treatment of extension staphyloma. Article 261
    bb. Treatment of adhesion staphyloma. Article 262
  c. Treatment of corneal ulcers.
    aa. Treatment of inflammatory ulcers of the cornea. Article 263
    bb. Treatment of resorption ulcers of the cornea. Article 264
Chapter IV. Treatment of sequelae affecting the iris.
  a. Treatment of synechia of the iris. Article 265
  b. Treatment of staphyloma of the iris. Article 266
  c. Treatment of secondary blennorrhea of the iris. Article 267
Chapter V. Treatment of sequelae affecting the lens and the vitreous.
  a. Treatment of cataract.
    aa. By drugs. Article 268
    bb. By extraction. Article 269
    cc. By discission. Article 270
    dd. By couching. Article 271
    ee. Care of the eye after cataract operations. Article 272

- b. Treatment of glaucoma. Article 273

Chapter VI. Treatment of retinal sequelae.
- a. Treatment of independent photophobia. Article 274
- b. Treatment of amaurosis. Article 275

Chapter VII. Treatment of sequelae developing in the central vascular system of the eye.
- a. Treatment of hydrophthalmus. Article 276
- b. Treatment of atrophy of the eyes. Article 277

BOOK SIX. SUPPLEMENTS.

Part one. Description of certain appliances utilized for eye patients.
- Chapter I. Eyeshades. Article 278
- Chapter II. Gauze goggles. Article 279
- Chapter III. Eye droppers. Article 280

Part two. Prescriptions.
- Chapter I. Medicines for internal use. Articles 281-287
- Chapter II. Medicines for external use. Articles 288-302

Part three. Bibliography. Article 303

Part four. Explanation of the copper-plate illustrations. Articles 304-309

BOOK ONE. SYMPTOMATOLOGY.

Article 1.

In order to obtain a true idea of Egyptian ophthalmia we must use caution in viewing not only the collective symptoms which represent the prototype of this disease, but also those symptoms which represent secondary manifestations of the disease. Now, since the former fall into well defined groups as regards the different stages of development of the anomaly (I have tentatively called them watering, discharge of mucus, and discharge of pus*), and the latter form special groups (because the secondary disease differs in various ways from the primary one), I shall list all the symptoms in question in accordance with the abovementioned divisions, which Nature herself has marked out.

Part one. Primary symptoms of the disease.

Chapter I. Signs of watering.

Article 2.

Watering of the eye is the mildest form of Egyptian ophthalmia. Watering is sometimes the only symptom and is sometimes associated with severer forms of blennorrhea. In the latter case it appears as the initial stage (at the outset), and as the final stage (toward the end of the disease). We usually see watering of both eyes. Occasionally it affects just one eye, and then preponderantly the right one. All symptoms of the stage of development in question point to definite anomalies of secretion, sensation, and structure. In the immediately following paragraphs these symptoms are listed strictly in accordance with these three changes.

Article 3.

In watering the anomaly of secretion always arises from impaired secretion of serum. At the surface of the conjunctiva there is secreted (through the lacrimal apparatus plays no part in it) a limpid fluid which, within certain limits, varies both as to quantity and as to quality. If the hypersecretion is mild we see the eyeball unusually moist and the eyelashes not only wet but also, here and there, sticking together without the existence of scabs. In the more advanced stages the serum either spurts forth or flows steadily over the eyelids, down along the cheeks. The serum is often quite insipid and tasteless, owing to a high oxygen content, and has no chemical action on the body. Sometimes it is sharp, with a salty taste, and because of a low oxygen content is so chemically active that striking changes occur in each spot touched by it. By virtue of the latter property the product of secretion causes inflammations, excoriations, and lichenoid eruptions upon the outside of the eyelids and also upon the skin of the cheeks. Sometimes the liquid in question was corrosive enough to make its marks upon the skin visible for a longer time, owing to their redness.

Article 4.

All structural anomalies which appear in watering of the eye with the abovementioned hypersecretion of serum occur mainly in the palpebral conjunctiva. In health the inside of the eyelid, which is covered by the conjunctiva and supplied with occasional small vessels here and there, is generally yellowish to light red in color, smooth, and just as brilliant as if it had a coat of very transparent varnish (1). In watering delicate, unusually small dots (clearly visible with the loupe) are conspicuous in all parts of that surface, in the upper eyelid as well as in the lower; they make this membrane appear dull and totally without luster to the naked eye. At the same time, in this condition, the coloring (yellowish to pale red) changes to a deeper red, apparently having the same extent; under a magnifying glass it is seen to result from a confusion of small lighter and darker dots, with receding of all vascular ramification. The redness of hydrorrhea is very decidedly different from the redness of all other forms of conjunctivitis. In other words, the coloring of conjunctivitis (which is occasioned by conjunctival inflammations alone) never has a punctate appearance, but the inflammatory process may always reach the palpebral conjunctiva or scleral conjunctiva as the result of hypervascularity. - The aforementioned symptoms visible at the palpebral conjunctiva are not the only ones connected with hydrorrhea. In addition there are some pathologic signs - almost never absent - in the structures adjacent to the membranous part mentioned. Thus, in addition to mild swelling, we commonly discover at the rims of the lids a plainly increased pinkness blending, as it diminishes, with the normal coloring of the outer skin of the eyelid; and most of the ocular conjunctiva is not only very dirty-looking but, owing to the ever present consensual action, bloodshot (traversed by single, more extensive small blood vessels).

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*Ὑδρόῤῥοια, φλεγμοτόῤῥοια, and πυόῤῥοια come from ὕδωρ=water or serum, from φλέγμα=phlegm, πύου=pus, and ῥέω=flow.

Article 5.

All the essential anomalies of sensation of watering arise from the general condition in part, and from the visual state in part. The troublesome itching of the eyelids - present from the very outset of the watering -, which necessitates scratching, belongs among the symptoms arising from a local change in the general condition. So does the sensation of roughness and dryness in the eye, which, because of the papillary bodies (2) developing, in spite of copious secretion of serum, is often so marked that many individuals definitely believe that a bit of dust or sand has gotten under their lids. So far as the anomaly of sensation is concerned, it is explained by increased sensitiveness of the retina. Patients generally do not open their eyes wide; as a rule they draw their eyebrows closer together; they seek out dark places; and, when looking at very bright objects, they complain of increased running of the eyes and of unpleasant, painful dazzling. More pronounced photophobia in watering is encountered only when the deeper structures of the eye show a marked inclination to participate in the disease originally confined to the conjunctiva. In addition, many patients also occasionally believe that their eyelids feel hotter, sometimes more plainly and sometimes less plainly so.

Article 6.

The duration of watering depends on how firmly the pathologic process is established no less than on its various relations to the remote causes. In general, watering may be the only symptom or may be associated with a more advanced stage of blennorrhea. We observe a long drawn out course when the anomaly, in constitutions which are moreover sound, has already become firmly established and the body

(1) According to Soemmerring, unless disease is present, the conjunctiva takes on a rough, velvety, papillary appearance only when the turgor vitalis is diminished and breathing has ceased altogether, in other words, at death. See Soemmerring, l. c., pages 28-31, table II, figures 10, 14, 15.

(2) See Articles 3 and 4.

constantly suffers minor injuries externally or internally. Many soldiers were sent to the hospital in this condition after they had left their station with every symptom of hydrorrhea, marched for eighty or a hundred miles*, and constantly suffered in the same way, without finding any essential change in their state of health. Several who had recovered from a severer form of ocular blennorrhea complained, in the same circumstances - often lasting weeks or months -, of the uninterrupted continuance of attacks of pure hydrorrhea. This stage of development, on the contrary, lasted but a short time in cases where it soon ended in complete recovery (whether in the presence of insufficient predisposition, as a result of slight, absolutely external causes), or where it inevitably led to discharge of mucus and discharge of pus (in the presence of dyscrasias and under the influence of serious injuries). Here the disease disappears altogether and we see many patients completely restored within a few days; and we see other patients exposed to the greatest danger within the same space of time, owing to the rapid development of the disease into more advanced stages.

Article 7

"Illustration of watering"

In order to give the best idea of the previously described symptoms, I assembled in the first copper-plate table a sketch of a perfectly sound eye and a sketch of an eye affected with watering. Both drawings show the lower eyelid rather everted, pulled down by the index finger laid upon it. If we compare the two pictures (sketched right from life) closely, they furnish a very clear notion of almost all the symptoms which characterize watering. In the upper picture, which represents the healthy eye, the inside of the lid is uniformly smooth, brilliant, and traversed by occasional single, delicate, small vessels; in the lower picture, which represents the diseased eye, the inside of the lid is seen, on the contrary, to be rough, dull, and nowhere covered with small blood vessels. Of course in a monotone copper-plate engraving it was impossible to show the yellowish to pale red appearance of the healthy palpebral conjunctiva, and the deeper red of the diseased palpebral conjunctiva (3). However, the engraving gives a satisfactory idea of the abovementioned lighter, even coloring of the normal eye, and the darker, more punctate coating of an eye affected with watering. We also notice how the scleral conjunctiva appears perfectly white and pure in the uninjured eye, and dirty-looking, shot through with individual small vessels in the diseased eye. Lastly, the difference between these conditions is perceived in those illustrations also because all the cilia of the sound eye are seen to be an equal distance apart, while those of the diseased eye, as a result of the hypersecretion of serum (4), are seen sticking together here and there, therefore to be an unequal distance apart.

Chapter II. Discharge of mucus.

Article 8.

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* Translators' note: A German mile equals nearly five English miles.

(3) I should willingly have had colored copper-plate engravings, after the masterly drawings executed by Caspar Grein of Cologne. But I decided against it when I discovered that the coloring of many copies, where everything depends on faithfully reproducing fine distinctions, is almost always a failure.

(4) See Article 3.

The discharge of mucus represents the stage midway between the mildest and severest degrees of trachoma. In the progressive form of trachoma it follows hydrorrhea and in the regressive form of trachoma, on the contrary, it follows the discharge of pus. Thus in the former instance it marks the period of transition to the most advanced stage, just as it marks a stage prodromal to recovery in the latter instance. Owing to these two tendencies, the symptoms in question (within certain limits always characterizing the stage of development under discussion) more closely resemble the symptoms of watering at one time, and the symptoms of discharge of pus at another time.

Article 9.

In the discharge of mucus the disordered secretion consists in the formation of a viscous, somewhat thick, white-gray, semi-transparent mucus. The more that this discharge is exposed to the air, as with the serum of watering, the thicker it becomes(5). The purely external discharge (namely, the part which collects at the tarsal edge) dries in the air to form yellowish, amber-like, dirty-looking crusts. These crusts cause the eyelashes of both the upper lid and the lower lid, when in repose for some time during sleep or in the presence of photophobia, to stick together so fast that it is hard to open the eyes without much rubbing. Sometimes individual particles of mucus remaining under the eyelids and upon the eyeball form upon the latter thin, white-gray, semitransparent pellicles moving about freely; The latter are best seen when they reach the cornea. If such crusts cover the entire region of the pupil, they cause blurred vision, colored rays, variegated rings, and other similar optical illusions; these illusions, however, are readily distinguished from actual visual defects because they disappear as soon as the cornea (by means of rapid opening and closing of the eyelids) becomes absolutely clear again.

Article 10.

All the structural anomalies accompanying the discharge of mucus, like those of watering, affect the palpebral conjunctiva mainly. Quite commonly they are much more pronounced than in the case of the analogous symptoms in the milder degree of the disease. By the same token, the inside of the eyelid (which is merely a little deeper red in the mildest form of the disease) presents a much darker coating in the middle stage, owing to a bluish tinge. The surface of the affected membrane, which during the previously described stage appears merely dull and without luster, looks definitely like velvet in this stage. In watering fine dots, so small that we can hardly see them with the loupe, stand out against the palpebral conjunctiva; in the discharge of mucus they are large enough to be recognized even with the naked eye as intimately intermingled, rounded off, unusually fine nodules of flesh. In watering, the as yet imperceptibly thickened conjunctiva presses close against the eyelid; in the discharge of mucus, on the contrary, owing to the well developed incipient papillae of flesh everywhere, we see the conjunctiva manifestly (though not markedly) swollen. In direct proportion as the anomaly is more pronounced inside the palpebral conjunctiva in the discharge of mucus, it is followed by a greater involvement of the structures adjacent to the palpebral conjunctiva. So far as the ocular conjunctiva is concerned, it suffers changes of two kinds. Its peripheral portion, covered while the eye is open, suffers watering; in these circumstances we always find it non-transparent, dull, without luster, entirely without vascularity, dirty-looking and pale red, and with so great a loss of cohesion that it positively creates coarse wrinkling when the eyeball moves. At this time the middle portion of the scleral conjunctiva (extending as far as the cornea) is no longer, as in the mildest form of blennorrhea, seen to be traversed by occasional, individual, pale (6) small vessels; on the contrary, it is seen to be traversed by numerous very red, small vessels, almost as in true conjunctivitis. The structural anomaly spreads more and more to the external layer of skin in the same way that it extends from the palpebral conjunctiva to the eyeball. The rims of the lids become redder, bluish for the most part; their deep coloring extends to a line at the outer skin; they lose the sharp contour formerly visible there internally and externally, and instead turn into a rounded off, somewhat swollen formation.

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(5) See Fourcroy and Vauquelin, 1. c., volume 10, pages 113-130, August, 1791.

Article 11

Of all the manifestations of the discharge of mucus, anomalies of sensation are the least constant. They depend entirely on the various tendencies which the middle stage of development is capable of showing. Their different modifications occur according to whether the process stops midway between watering and the discharge of pus, or whether the process more closely resembles the latter degree (by advancing) or the former degree of the disease (by regressing). Indeed, during the arrest of the process, the feeling of dryness and roughness disappears to such an extent (thanks to the smegmatous mucus which diminishes friction) that it is present only during greater excursions of the eyeball; nevertheless, patients complain of annoying photophobia, exacerbated every evening, as well as of troublesome itching of the eyelids sometimes interrupted by burning. Where the discharge of mucus is progressive we are especially liable to encounter anomalies of sensation as sequelae. Every movement (even the slightest) of the eyeball is painful; the tarsus proves to be unusually sensitive (no matter how gently it is touched); instead of itching there is unpleasant burning, sometimes accompanied by transitory stabbing pains; and at the same time the photophobia becomes so severe that the eyes can be opened only in semi-darkness. If the disease shows a regressive tendency, the pathologic sensitiveness of the eyelids to being touched disappears altogether, the periods of burning in the eye do not return, the itching is appreciably diminished, the photophobia is almost wholly absent, and the feeling of suppleness and of welcome lightness increases in direct proportion as the incipient papillae of flesh recede more and as the conjunctival texture in this way more completely recovers its normal smoothness.

Article 12

As for the duration of the discharge of mucus, it is by no means limited to a definite length of time. As in the case of the mildest stage of development (7), in the discharge of mucus the longer or shorter course depends partly on whether the anomaly has a weak hold or a firm hold, partly on the various connections of the process with its remote causes. In proportion to these circumstances the discharge of mucus sometimes comes to a rapid end and sometimes lasts for several weeks or months. Let me also note that I regard an illustration of the discharge of mucus as superfluous, since all manifestations of this stage of trachoma (if one has first grasped the meaning of watering) are rendered sufficiently clear by the description given above.

Chapter III. Discharge of pus.

Article 13.

(6) See Article 4.

(7) See Article 6.

It makes its appearance as the most virulent form of the anomaly with effusions of purulent fluid, and with that transformation of the conjunctiva which causes the individuality of the diseased structure to be utterly lost in the formation of papillary bodies. When the discharge of pus is at its height, its spread from its original focus (from the palpebral conjunctiva) is seldom slow but much oftener rapid; it then reaches, with inevitable destruction, not only the ocular conjunctiva but even the innermost parts of the bulb. In the latter condition it is exceptional for the discharge of pus to involve merely one eye; it much oftener involves both eyes, and usually affects the first eye worse.

Article 14.

The following facts are to be noted *regarding the anomalies of secretion*. The purulent fluid which is secreted in the discharge of pus most closely resembles the yolk of an egg thinned with some water. It is very definitely distinguished from the serum no less than from the mucus by its yellowish white coloring as well as by its total lack of transparency. The sometimes smaller and sometimes larger amounts in which the pus is formed give rise to certain special manifestations. If the secretion is not very copious, the pus which appears outside and is exposed to the air produces brownish non-transparent scabs adhering to the cilia, while the rest of it remaining moist behind the eyelids collects in various parts of the deeper folds of the palpebral conjunctiva. Where there is more active secretion, we often see the palpebral aperture closed for the most part with thick, large, very extensive crusts. Through the internal angle of the eye the pus collects here toward the root of the nose and amounts to several drops. If the eye is opened in these conditions, the purulent fluid overflows the rims of the lids at the slightest pressure. Where the process of secretion reaches a still higher degree, the very highest degree, the pus creates special paths for itself by force through the closed palpebral aperture at several points (usually three to five); through these paths it trickles down the cheeks in single, fairly wide streaks. If in the latter circumstances the eyelids are separated, the secretion appears in such amounts that, as it rapidly streams forth from the entire palpebral aperture, it immediately covers most of the face; furthermore, at first glance, the eyesocket no longer seems to contain the eyeball but merely pus; and it is possible to collect from 2 to 4 ounces of the secretion from individual patients within 24 hours. There is less variation in the quality of the pus than in its quantity, within certain limits. For the most part the only qualitative variation is in the consistency. In other words, sometimes the purulent fluid is very thin, sometimes it is definitly thick, like butter melting. Indeed, at this stage (where there is excessively rapid development of the papillae), there are in addition greenish, yellow, red-streaked secretions resembling the blood liquor, and even completely bloody secretions. Yet we may consider these, owing to their exceedingly short duration, merely as intercurrent; and, since they never appear in most individuals, we may always consider them merely as perfectly accidental occurrences.

Article 15.

The structural changes which result from the purulent secretion involve, according to the different extent of the disease, the palpebral conjunctiva alone, or the ocular conjunctiva as well. In order to avoid confusion as much as possible, we shall term the abovementioned slight degree of extent *blepharo-pyorrhea**, and the abovementioned more advanced degree of extent ophthalmo-pyorrhea*. In both cases the symptoms are in part definitely connected with the extent, and in part are variable. Next, I shall enumerate the first type of symptoms (the essential ones) in the order in which they appear from one or the other degree of extent. Then I shall enumerate the second type of symptoms (the less constant ones) in the order in which they appertain to the changed structure of the outer skin of the eyelid in general, and to the eversions of the palpebral conjunctiva in particular.

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* From βλέφαρον= eyelid, πύον= pus, and ῥέω= flow.

Article 16.

a) When blepharo-pyorrhea is present, the entire suface of the palpebral conjunctiva appears to be composed of prominent, rounded, larger and smaller papillae of flesh resembling warts, to be swollen and puffy, and in general to be completely blood-red in color. Throughout the entire course of this extent of the disease, that dark red saturation is relieved by individual light yellow spots. These spots are irregular in shape when fairly large, or perfectly round when very small in diameter. The irregular shape indicates that they are merely collections of pus which are found inside the grooves visible between the papillae of flesh. The round spots show that they are the pores of the papillae, from which the pus, whenever wiped away, streams forth as from the pores of a sponge. Once the development of the papillae, as described above, extends to all parts of the palpebral conjunctiva, the disease always spreads to the ocular conjunctiva with its two lower stages of development. The following takes place, to a lesser or greater degree, according to circumstances. -

In the first case, we see the discharge of mucus from the scleral conjunctiva next to the eyelids, and discharge of water from the scleral conjunctiva next to the cornea. Here its peripheral portion is always bluish red, plainly velvet-like; the more central portion, as far as the cornea, is without vasculosity, dull, a dirty pale red in color, and puffed up (sometimes less, sometimes more). In proportion to the swelling the conjunctiva forms either a faintly raised ring or a very high wall around the cornea, which is still intact and perfectly clear. Underneath we find the groove resulting from such a circular swelling filled with pus. As soon as this pus is removed with irrigations, the cornea (still free from blennorrhea) is visible in the middle of the groove as a black, moderately elevated disk, exceedingly smooth and sometimes unusually brilliant in spots. On some occasions I saw these conjunctival swellings pushed forward like a hill between the eyelids; but this is a rare occurrence, because the scleral conjunctiva usually suffers less from blennorrhea than the palpebral conjunctiva does. -

In the other case (namely, where the pathologic process, during its stage of pyorrhea confined to the eyelids, attains with the lower stage of its development an extent wider than the abovementioned one), the scleral conjunctiva as a whole discharges mucus, and the conjunctival membrane undergoes watering in part or as a whole. If propagation to the conjunctival membrane is only partial, the cornea (which, moreover, is sound) is found to present but few gray dots, which are isolated and without luster. But if the entire conjunctival membrane is involved, then the entire corneal surface likewise becomes dull, as if covered with dust, and dirty gray in color without on that account losing its normal form; it becomes so clouded that, though the color of the iris and the outlines of the pupil can actually be seen through it, they do not shine through clearly.

Article 17.

b) Ophthalmo-pyorrhea is present when the formation of papillae spreads from the inside of the eyelid to the eyeball. Here we find that, apart from the palpebral conjunctiva, the scleral conjunctiva suffers more or less pyorrhea in the more circumscribed degree of the disease, and that all the membranes of the eyeball are thus affected in the more advanced degree. When there is less spreading of the disease the conjunctiva, as far as the cornea, appears (because of small round granulations) wart-like, blood red, dotted (8) in some places with light yellow spots, and so swollen that it forms a well raised circular wall almost entirely concealing the cornea. Wherever the disease, in the form of pyorrhea, affects the entire scleral conjunctiva, as regards the two lowest stages of development it no longer remains confined to the conjunctival membrane but spreads to the corneal lamellae and the adjacent deeper parts of the eye space with them. Therefore, during this spreading stage, sooner or later, definite injuries to the cornea and characteristic processes inside the eyeball develop. They are to be identified by the fact that the cornea appears entirely non-transparent, doughy, shrivelled, dirty gray, sometimes like chalk. The deeper anomalies mentioned become apparent, as internal hydrorrheal secretions, by the fact that the most anterior part of the eyeball swells by degrees until it bursts, whereupon fluid (for the most part limid) escapes.

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* From ὀφθαλμὸς eye, πύον= pus, and ῥέω= flow.

Wherever such collections take a long time to enter the chambers, we plainly see: how the cornea (discharging mucus and rendered soft) constantly becomes increasingly visible from the depth of the circular wall, in whose center it lay hidden; and how the cornea hereupon becomes a fissure from which at first merely serum and finally also the lens (for the most part without further, particularly noticeable symptoms) issue forth. When the internal secretion in question proves to be not sluggish but on the contrary violent, the corneal tissue suddenly bursts (without its being possible to have a good view of the symptoms just mentioned), with a noise which makes patients tremble, and with such force that the expelled lens often alights far from the eye.

Similarly, when complete rupture has taken place, it may happen in the former or latter way that the cornea will present a perfectly black, lustrous, almost perfectly pointed-oval opening, through which patients sometimes see moderately well, though always for but s short time. If the disease terminates in evacuation of the lens without spreading, as pyorrhea, beyond the borders of the scleral conjunctiva, the eyeball collapses and the wound heals (and usually the cornea is completely absorbed), leaving a dark, bluish gray scar. When, as described above, there is further spreading of the pyorrhea (in which the highest degree of development of the process is not confined to the circumference of the cornea, but with all its characteristics extends to the deeper parts), all the parts of the eye most concealed also lose their characteristic structure as soon as the rupture has taken place in the manner described, in consequence of the rapidly increasing formation of papillae. Here there is fusion of the cornea, of the iris, of the sclera, of the choroid, and of the retina into a shapeless, spongy, blood-red mass of flesh abounding in light yellow pores. For the most part the secretion diminishes at once; only exceptionally does it wait until long after that transformation to cease. As soon as the secretion regresses, the swelling in question goes down more and more until at last, when the disease has run its course, it dwindles to a pale red lump covered with firm epidermis far back in the orbit.

Article 18.

c) The outside of the eyelid differs greatly from normal during the discharge of pus, because of tumor-like swelling no less than because of changes in its color.

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(8) See Article 16.

The noticeable thing about this swelling is that, in these conditions, we find it by no means limited to the tarsal edge (as in watering and the discharge of mucus), but spreading to the orbital arch sometimes more and sometimes less conspicuously. In the milder form of pyorrhea, the puffed up lids come so close together that the eye can rarely be opened without outside help. Nevertheless, the tarsal edges merely meet, without actually overlapping. In the more advanced form of pyorrhea, the upper eyelid (larger and more mobile) is stretched in all dimensions over the lower eyelid. We then see: the tarsal edge of the upper lid drooping as far down as the lower limit of the orbit; all its cilia (which normally lie close together) pushed half a line - even a whole line* - apart from one another; and the whole external surface of this membranous covering so puffed up that, looking as if it were an inch high, it towers far above the root of the nose, the region of the forehead, and the region of the cheek. It is utterly impossible to discover the eyeball in such an intumescence, even with the proper instruments. On carefully raising the upper eyelid good and high at this period, at most the only part visible is the tarsal edge of the lower eyelid. Moreover, regardless of the forms of swelling discussed, so far as the coloring of the outer palpebral lamellae is concerned, it too is always profoundly changed where pyorrhea prevails. Without exception I found the tarsal edges very dark red, and the whole palpebral skin the color of lead in mild pyorrhea and pale violet red in advanced pyorrhea.

Article 19.

d) Primary, fungous eversions of the eyelid (which are observed as accidental concomitant aspects of pyorrhea) are present whenever this process so greatly promotes the growth of papillae that the latter, projecting from the stroma of the palpebral conjunctiva between the anterior surface of the eyeball and the eyelids, no longer have enough room. That condition seldom occurs in progressive pyorrhea, in which the inside and outside of the eyelid expand at an equal pace, for the most part (9); more often, however, it appears during regression of trachoma, during which stage the expansion of the outer lamellae soon stops and the expansion of the inner lamellae, on the contrary, is very slow in coming to an end. In the beginning, the eversions result only from special causes: from continuous pressure during defecation; from repeated yawning; from arching the eyebrows; and from attempts to open the eye. Later, they occur also without any external insult, while the profusion of granulations increasingly pushes outward quite spontaneously. When the former origin prevails, the eyelids turn in just as readily as they turn out again at every fresh occasion; when the latter origin revails, attempts at reposition are often, on the contrary, a total failure. Usually the magnitude of the octropion is in direct proportion to the degree of spreading of the pyorrhea; yet this is not universally true, by any means. Therefore, even in very markedly exuberant eversions, we sometimes see pyorrhea which nevertheless extends merely to the edge of the cornea. The individual papillae of these exuberant eversions are in every way like those which appear in pyorrhea unaccompanied by eversion; they are composed of round, very soft, flexible papillae having many yellow outlets. -

If only the upper eyelid has developed primary ectropion, the projecting papillae (which have degenerated into a large tumor) so fully occupy the region of the eye htat two things occur: its drooping, convex portion falling over the lower eyelid comes to rest upon the lower orbital arch; and its upper, straighter edge appears inclined well upward. The cilia of the overted eyelid along the wholly everted tarsus are, accordingly, pushed upward to the eyebrows and their upper parts are forced back so hard that they lie against the corium. Such forms of ectropion are likewise always accompanied by marked wrinkling of the eyebrows and of the skin in the vicinity of the upper orbital arch. -

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* [Translators' note: A line is equivalent to 1/12 of an inch.]

(9) See Article 18.

In eversion of the lower eyelid, we see its cilia bent down in such wise that their lower parts press against the skin of the cheek. When these forms of ectropion are more pronounced, the papillae are often so copious that they entirely conceal the rim of the lower eyelid and push the rim of the upper eyelid well up toward the eyebrows. -

Where both lids suffer ectropion at the same time, the tips of the cilia of the upper lid brush the skin of the face above, and the tips of the cilia of the lower lid brush it below. When there is less eversion, we find that the eyeball is actually surrounded by an upper granulating tumor and a lower granulating tumor, but that its middle portion is intact. The eye is completely hidden only when the anomaly reaches a more advanced stage in these conditions. -

Either of two things may be the outcome of all eversions resulting from the discharge of pus. Either the papillae recede constantly and increasingly as the secretion lessens, until the eversion almost ceases. Or, as the secretion diminishes, the papillae constantly become stiffer and manifestly firmer, and so altered that almost nowhere do we still detect their outlets. In the former instance, the normal configuration of the eyelids is automatically restored when the discharge of pus has altogether ceased. In the latter instance, the primary fungous eversions, on the contrary, are transformed into out and out sarcomatous tumors and properly belong among the sequelae (10).

Article 20.

In a general way, the anomalies of sensation of pyorrhea exceed those (11) of all other stages of development in both intensity and extent. These anomalies are differentiated according to whether the pyorrhea is mild or virulent, and according to whether it is increasing or decreasing. As soon as the discharge of mucus turns into the discharge of pus, the attacks of photophobia increase to an extraordinary degree. At about that time, the whole outer skin of the eyelid immediately becomes very sensitive to being touched, and it feels very hot; this sensitiveness is limited to the rims of the eyelids in the discharge of mucus (12). Now there is also uninterrupted continuation of burning of the eyelids; in the middle stage of blennorrhea this burning is only spasmodic. Here the transitory stabbing pains (which in progressive discharge of mucus are seldom present, and then are confined to the region of the eye) come as quick as lightning and extend deep into the eye, its adjacent parts, and the whole forehead. In addition, severe headache and distressing insomnia are associated with all this. As a rule, all the anomalies of sensation just mentioned diminish a little in the morning and throughout the day; but towards evening they recur, and around midnight they reach their peak, in general. If there was severe pain during the night, on the following day we find either a correspondingly very copious discharge of pus, or a markedly increased swelling of the palpebral skin (which, moreover, was already much swollen).-

During the aforementioned anomalies of sensation, the process never remains very long at any one degree. During them, within a short time it always becomes either regressive or very advanced. Where it is regressive, every recurrence of the nervous anomalies just mentioned proves to be somewhat milder; they gradually

(10) See Article 27.
(11) See Articles 5 and 11.
(12) See Article 11.

abate in every respect until they reach the form in which they accompany the discharge of mucus and watering (13).

If, on the contrary, the anomaly proceeds unchecked, the aforementioned midnight exacerbations likewise extend to the daytime, so much so that remissions are barely still perceptible. In such conditions patients suffer distinct photopsia, even in perfectly dark rooms, and when their eyes are shut tight: at times they are dazzled by various violet circles, flame-colored blazes, brilliant flashes, scintillating stars, or colored balls. During these attacks of true photopsia, the hot feeling in the eyes invariably assumes such proportions that patients feel as if a glowing coal were right in their orbit, as if a red-hot iron were boring deep into their orbital walls. The latter excruciating pains are invariable followed by general violent reactions on the part of the nervous system, namely: a most distressing feeling of anxiety, an irresistible desire to change position, and not seldom actual delirium.

If patients in that condition do not lose consciousness, they feel as if their eyeball were getting bigger and bigger, as if their eyesocket were not large enough to contain it, as if it were constantly protruding further. This goes on until (in the midst of pains, which make even the bravest despair and force many to beg that their eye be removed) bursting of the cornea puts an end to their suffering. Immediately after the ensuing bursting of the eye (thanks to which most persons obtain instant relief), the nervous disorders diminish swiftly as a rule, and slowly once in a while; here they are as limited as in the lower stages of blennorrhea (14).

Article 21.

The duration of the different types of pyorrhea is not always the same. They are of short duration when they are well established and, causing increasingly serious injuries, inevitably penetrate to the inside of the eye. Here the cornea sometimes bursts as early as the third or seventh day after the discharge of pus has started; here the process in question terminates either simultaneously with the bursting or very soon after it.

This stage is of long duration when the disease is not very well established and when only slight injuries to the organism result. Here the disease lasts, for the most part, three weeks, and sometimes even five and eight weeks. -

Another noteworthy point is that the return to normal is never immediate, but that, before restitutio ad integrum, the pyorrhea always dwindles first to the discharge of mucus and then to watering.

Article 22.

Illustrations of the discharge of pus.

The second copper-plate table shows those changes which are perceived at the fastigium of the development of the disease when the palpebral aperture cannot be seen. This drawing, faithfully copied from Nature, essentially portrays the monstrous palpebral tumor which makes its appearance in the conditions described. Both the right side and the left side show us the upper tarsus (with its widely separated cilia) pushed far down to the lower orbital arch, both eyebrows clearly pushed up toward the forehead, the lower lid completely hidden, and the anterior wall of the upper eyelid towering like a hill above the region of the nose, forehead, and cheek. This copper-plate engraving not only illustrates the frightful swelling associated with advanced trachoma but also faithfully portrays the characteristic discharge of albuminous pus (never absent in severe pyorrhea), which runs down the whole cheek in separate, fairly wide streams; the latter grow narrower as they descend.

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(13) See Articles 11 and 5.
(14) See Articles 5 and 11.

Article 23.

In order to give as graphic a reproduction as possible of all the more important symptoms whose starting point (mainly owing to the formation of papillae, but also owing to the different forms of ectropion) is the inside of the eyelid, I provided drawings sketched during complete eversion of the eyelids; these drawings form tables three and four. -

Table three shows the maximum formation of papillae. The artist and the engraver have graphically portrayed the hill-like conjunctival granulations of the fastigium. Both the illustration at the top and the illustration at the bottom plainly show the very dense formation of perfectly round, greatly elevated papillae, together with their numerous light-colored outlets. The general impression produced by both pictures makes evident to everyone the unusually soft, loose, spongy texture characteristic of the conjunctival stroma in the discharge of pus. Likewise, the manner in which the pus makes its appearance at this time is very faithfully represented; we fully realize how the thicker secretion (several fairly large drops of which have collected under the swollen flesh), when the formation of papillae is more pronounced, escapes after attempts at cleansing, to run down the entire cheek as previously described (15). -

The changes in the palpebral conjunctiva during the regression of pyorrhea are shown by the upper figure in table four. Here the individual granulations in the upper lid (which is turned inside out and has been cleansed with irrigations of water) are no longer distinctly far apart but, as compared with their earlier elevation, are much flattened and deprived of nearly all their light-colored pores. In the same figure we note that the secretion of the opposite eyelid (the lower eyelid, which is not free from purulent fluid) takes place in a manner far different from the one when the anomaly is progressive. Even at this period the discharge very closely resembles mucus; hence it no longer collects in large, oval, individual drops (16) but in several small masses which are without any definite shape, as is brought out in a masterly way in the illustration. Table four likewise shows us that the regression of the pathologic process is already well under way, because we see some small isolated vascular ramifications (which are always present in the milder stages of the disease only, as the result of consensual affection) in the scleral conjunctiva; the latter (which previously was uniformly red) is dull, dirty-looking, and cloudy (17).

Now that I have described the illustrations in plates three and four with reference to the appearance generally presented by the conjunctiva in the discharge of pus, it still remains for me to explain the illustrations also in so far as they at the same time depict the different forms of fungous ectropion. Table three gives us a clear idea of eversions of the upper eyelid. In it the picture at the top gives us a front view of such an eversion, and the picture at the bottom gives us more of a side view. The upper one shows especially how the swelling extends from one canthus to the other; in the lower one the marked swelling of that lump of flesh forward is more conspicuous. The two pictures together prove to us: how the papillae (present in excess) involve the whole ocular region; how (with their lower convex part, drooping toward the cheek) they conceal the lower eyelid; how

(15) See Article 22 and Table II.
(16) See Table III.
(17) See Article 10.

their uppermost, straighter edge is turned well up toward the eyebrow; how the upper part of all the cilia of the diseased eyelid is pressed against the corium; how much the skin lying between the eyelid and the eyebrow is creased, and how much the forehead is wrinkled on this account. -

The form taken by eversions of the lower eyelid appears plainly from the second figure of table four. So far as the pathology is concerned, this illustration is an exact reproduction of an engraving given in the monograph of Vetch (18). But, so far as the very unsatisfactory picture given by the original is concerned, I have adapted it to fit in with my other copper-plate engravings. Instead of using two very satisfactory drawings of ectropion of the lower lid (made in my presence at the bedside of patients), I preferred to have Vetch's engraving copied precisely because, in view of a parallel to be discussed later, it cannot well be omitted (19). This illustration clearly shows how the papillae cover the whole region of the eye in complete eversion of the lower lid, how far down the cheek they extend, how far up they push the cilia of the upper lid without changing their direction, and how much the skin lying between the eyelid and the eyebrows is consequently wrinkled. -

The upper figure of table four depicts simultaneous eversion of the upper lid and of the lower lid. Both the everted lids are sketched in the exact position which they occupied during mild separation from one another, on account of which the eyeball was more exposed. It is at once clear from the pronounced arching of the eyebrows that that separation took place with some force. This copper-plate engraving renders conspicuous the cilia of the everted upper lid with their upper end pressed close against the corium, and the cilia of the everted lower lid with their lower end pressed close against the corium.

If the reader, after careful consideration of all the illustrations representing blennorrhea of the palpebral conjunctiva, will glance back at the detailed description of trachoma, he will have a true and vivid conception of it, even though he has never observed the disease clinically.

Part two. Secondary symptoms of the disease.

Article 24.

The various sequelae of trachoma arise in three ways: 1- the original disease, from the start, strives to change the cellular basis of the structure affected; 2- the original disease causes sympathetic inflammation in the adjacent membranes; 3- the original disease undermines the vitality of the eye, sometimes less and sometimes more. In order to ascertain the connection between the original disease and all the sequelae, in this special section of the book I shall carefully note the laws according to which every single one of these secondary anomalies develops. Moreover, it is my intention to point out very briefly the particular sequelae which are fully discussed elsewhere, and to give a detailed account of merely the sequelae which so far have received insufficient attention.

Chapter I. Sequelae affecting the eyelids.

Article 25.

Since the conjunctiva united with the Meibomian glands is, with reference to its covering of mucous membrane, most prominent at the eyelids, the latter form the natural focus of the disease. The disease begins in the palpebral conjunctiva, spreads to the whole eye from it, and returns to the palpebral conjunctiva in its terminal stage (20). As a result, trachoma affects the eyelids worst, which fact likewise explains why secondary anomalies most commonly affect these very structures.

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(18) See reference on page 55 of the English text of Vetch, i. c., to engraving number 1 at end of book.
See also page 35 of the German translation of Vetch's book prepared by Michaelis.
Both refer to the lowermost illustration in the copper-plate engraving appended.

(19) See Article 115.

Article 26.

a) Subsequent loss of cohesion of the palpebral conjunctiva.

The edema which we note (21) in the palpebral conjunctiva during the advanced stages of trachoma rarely disappears altogether with the rest of the pathologic signs. Almost without exception, there is more or less loss of cohesion on the part of the tissue of the palpebral conjunctiva after the anomalies of sensation and secretion peculiar to trachoma have come to an end. If this loss of cohesion is so great that, without precisely causing tumor-like edema, the sequela in question nevertheless continues quite independently, we find ourselves faced with this secondary disease.

It is characterized by the following symptoms: the outside of the eyelid is seen to be traversed by several dark colored small vessels which, though minute, are nevertheless plainly extensive; the inside of the eyelid appears without luster, dull, velvety in spots, and dark red everywhere; serous secretions are by no means constantly present but develop very readily at the slightest irritation, raw weather, cold, looking at brilliant objects in a strong light. Although this disease in many respects resembles watering and the discharge of mucus, we cannot mistake it for either the former or the latter. The subsequent loss of cohesion is very sharply differentiated from both by reason of two facts: in it hypersecretions of serum, sometimes producing erosions, are as inconstant as the discharge of mucus; in it we do not observe increased heat, annoying itching, and sharp burning of the eyelids, unusual sensitiveness to being touched, and all the aforementioned manifestations of severer photophobia. This makes two things clear: how, in this sequela, almost all the anomalies of secretion and sensation peculiar to watering and the discharge of mucus are wanting; and how merely the structural anomalies (and even those only to an incomplete degree) are the only anomalies of the two stages of trachoma mentioned which remain behind in the loss of cohesion (22).

Moreover, so far as the importance of this condition (which often lasts for months, and even for several years) is concerned, the condition is indeed a barely perceptible sequela of the previous trachoms and means nothing at all; but it is of great importance in that it tends to favor recurrences of the original disease in the future.

Article 27.

b) Sarcomatous ectropion.

The sarcomatous forms of ectropion which appear at an advanced stage of secondary loss of cohesion do, indeed, in many ways resemble the primary forms (23) from which they develop in the manner already described. However, the secondary

(20) See Articles 2-23.
(21) See Articles 4, 10, 15, 19.
(22) See Articles 3-5 and 9-11.
(23) See Articles 17, 19, 20, 23.

forms are by no means to be regarded as identical with the primary forms. The primary forms of ectropion result solely from the discharge of pus, which latter does not occur in the secondary forms. The primary forms are characterized by granulations which are conspicuously elevated, perfectly round, and furnished with numerous outlets; these granulations feel soft, fungous, and very spongy; they seem to be lacking in cohesion, to be readily compressed, to have a low specific gravity, and always to be accompanied by excessive discharges of pus and also sharp pains. The secondary forms, on the contrary, are characterized by individual granulations which are flatter, vague in outline, and almost without outlets; for the most part they are not accompanied by pains, their specific gravity is very high, they are tough (sometimes almost like cartilage); and they are associated with a very mild anomalous secretion which is purely a sympathetic reaction. With reference to the variety of degrees of involvement, and just as much with reference to the general form, sarcomatous eversions are identical with the fungous forms already described (24).

The only other facts worth mentioning are that: this sequela, throughout its duration, tends to favor the recurrence of trachoma; secondly, owing to constant irritations of the eyeball this sequela gives rise to destructive inflammation sooner or later; and lastly, after spontaneous termination, in unfavorable circumstances this sequela is sometimes succeeded by frankly scirrhous or carcinomatous conditions.

Article 28.
c) Entropion.

Entropion of the eyelids never results from acute persistent discharges of pus associated with marked granulation of the palpebral conjunctiva, but indeed from chronic persistent discharges of mucus and watering. Not once did I see a case of entropion in the many hundreds of patients treated during the war. But later, when the campaign was over, on many occasions I saw entropion in those persons who for long years had suffered from very mild trachoma. Owing to the fact that, in the conditions just mentioned, the trachoma is very long drawn out, the palpebral conjunctiva undergoes a noticeable solution of continuity associated with manifest shrinkage; this happens because the palpebral conjunctiva has almost wholly ceased to function. As soon as this condition reaches a certain degree, it always gives rise to entropion. Since, moreover, entropion as a sequela of trachoma differs in no way from the entropion which has long since been common knowledge, any special mention of it lies outside of the scope of this book.

Article 29.
d) Ptosis.

Ptosis appears with and without secondary loss of cohesion of the conjunctiva. If a mild degree of ptosis is present when nothing is wrong with the palpebral conjunctiva, in time it usually goes away by itself. But the drooping of the eyelid becomes permanent where it has already reached an advanced stage spontaneously and separately, or where, owing to concomitant loss of cohesion of the conjunctiva, it continues present.

Next in order among the circumstances most favorable to the creation of ptosis come the overdevelopment of all the palpebral layers - never absent when the discharge of pus is considerable (25) - and also, phthisis, loss of vitality (which takes place in the eyelids as the result of the large loss of fluid connected with that process). The effects of this defect vary greatly with the different stages of the disease. In mild ptosis the palpebral aperture still exists, to be sure, but it is anything but wide; consequently, although use of the eye is not impossible, it is nevertheless remarkably difficult. When the ptosis is more pronounced we find the whole eyeball covered up, and here the patient must push the helpless drooping lid up with his fingers if he wishes to see.

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(24) See Articles 19 and 23.

Chapter II. Sequelae affecting the ocular conjunctiva.

Article 30.

The description of the different periods of evolution of trachoma plainly shows how the disease gradually spreads from the eyelids to the scleral conjunctiva (26). Now, the more deeply that the ocular conjunctiva is involved and the greater the changes that its structure undergoes, the more pronounced are the sequelae affecting it when the trachoma proper is over; the resulting membranes or ulcerations form separate and distinct sequelae.

Article 31.

a) Ocular membranes.

Careful observation of these sequelae of trachoma shows us that there are two main varieties of ocular membranes. They appear rather as the product of hypervascularity, or else rather as the result of increased cell formation.

aa) The first or vascular type of membrane (identical with pannus) arises particularly from those forms of trachoma which, without going beyond the lower stages of development, last for many weeks or months. If these discharges of mucus, or milder blepharo-pyorrheas, last for a longer time, the ocular conjunctiva never remains free from sympathetic inflammations always connected with increased vascular ramification (27). If the expansion of the blood vessels now becomes considerable, completely independent secondary diseases (having no connection with the original anomaly, and having all the attributes of vascular ocular membranes) [illegible] ery likely to result from it. In the initial stages of pannus, in spite of [illegible] ny small vessels diffused over the cornea, we can still distinguish the outlines of this membrane clearly. Later on, however, these ramifications multiply to form a network so dense and so edematous that at the site involved it is no longer possible to distinguish the place where the sclera and cornea meet. If this tissue has formed on one side only and at first involves merely a small part of the cornea, it spreads slowly, as a rule.

But where the vascular ramification invades the cornea on all sides right at the start (that is, in peripheral pannus), it spreads much more rapidly, In either form, as soon as the cornea is wholly affected with pannus, the underlying iris and pupil are glimpsed through the crimson vascular network only when the intensity of the disease is very limited. In the advanced stages the anterior surface of the eyeball, toward its center, resembles a solid red carpet which is altogether lacking in transparency and is composed of intimately intermingled vessels. When these ocular membranes continue present until they are chronic and inflammatory processes, they are always accompanied by extensive pains, by photophobia, by manifest tumor-like edema of the conjunctival membrane, and not seldom by reddening

(25) See Table II.
(26) See Articles 2-23.
(27) See Articles 10, 16, 23.

of the corneal texture. When the membranes are partial and not very thick, they often respond to proper treatment and disappear without leaving a single trace. But pannus always leaves the entire cornea covered with a membrane, even when the formation of corneal opacities is not very marked. If the malformation resulting from the abovementioned sequela extends from the conjunctival membrane deep into the underlying lamellae, the outcome is very unfavorable: the vascular membranes are then transformed - with increasing pain, owing to true partial inflammation of the cornea (28) - into actual adhesion staphylomata, or they leave chalk-white, adynamic, incurable corneal spots (29) behind them when the vascular network disappears.

bb) The second main type of membrane or cellular membrane is identical with pterygium. It is liable to appear after all forms of trachoma (30) which have reached the scleral conjunctiva. Owing to such spreading of the disease (which is even more proportional in intensity), the delicate tissue of the ocular conjunctiva always suffers a considerable loss of cohesion. When this occurs, the ocular conjunctiva seldom escapes unharmed when the anomaly disappears; while there is general improvement, this membrane is almost always left with certain small spots which are elevated, dull, non-transparent, and dirty red. If the anomalies of vegetation of those small spots are not soon removed by proper treatment, almost without exception they develop into genuine cellular ocular membranes. This usually happens at a period when the eye is well on the way to recovery so far as all other circumstances are concerned. During this particular period the tiny diseased spots seem to attract all the anomalies still left in the other parts, and to join forces with them. At about this very time, as a rule, they become even more conspicuous owing to a darker red color, to a clearer outline, and to increased edema.

As soon as the cellular ocular membranes have become completely independent in the manner described, their fate is determined by the etiology. Many proceed to even more advanced stages, their progress being uninterrupted; their growth is rapid and their whole surface sends forth small granulations which are close together and secrete some pus. This variety of pterygium is soon transformed into manifestly fungous vegetations (31); to a certain extent, their relation to the ocular conjunctiva is almost the same as the relation of pus-secreting granulations to the palpebral conjunctiva in fungous extropion (32). Other membranes (which for etiologic reasons are less benign) stop half way in their development and resemble a blood red thick skin (33). Their tissue does not develop into pus-secreting granulations shaped just like a hill, but into a flatter, tough vegetation which in fineness of texture resembles the growth seen in sarcomatous ectropion (34). Lastly, if there is soon further regression of the pterygium which has not yet gained much ground, owing to the abatement of all untoward influences at an early date, its sequela takes the form of white, thin, bloodless membranes composed of thick cell material (35). In view of those facts, therefore, the first variety of pterygium (the fungous) appears as a partial pyorrhea (complete as far as it goes); the second variety of ocular membrane (the sarcomatous) appears as a similar permanent condition (but incomplete with reference to the structural anomaly alone); and the third variety (pterygium tenue) appears as a faint trace of previous tra-

(28) See Article 36.
(29) See Article 37.
(30) See Articles 16-17.
(31) Pterygium fangosum, or fungous ocular membrane.
(32) See Article 19.
(33) Pterygium sarcomatosum, crassum, or thick ocular membrane.
(34) See Article 27.
(35) Pterygium tenue, ungula, or unguinal membrane.

choma which affected some parts of the ocular conjunctiva. These differences between those three varieties of cellular ocular membranes explain why pterygium fungosum develops very rapidly, why pterygium sarcomatosum develops less, and why pterygium tenue does not develop at all.

For the most part, all the sequelae described begin in the region of the semilunar fold, in other words, where the scleral conjunctiva most closely resembles mucous membrane because of its proximity to the caruncle. On rarer occasions they develop at other points of the ocular conjunctiva; on such occasions they develop only in the part which is adjacent to the palpebral conjunctiva. Usually, only one such membrane is found in a single eye. Owing to the course followed by the conjunctiva from the eyelids to the cornea, from the periphery to the middle, almost all pterygia are triangular; thus the base of the triangle faces the palpebral conjunctiva adjacent at the periphery, and its apex faces the corneal membrane situated in the center. The spreading of the pterygia to the front and sides is more active, while their spreading to the deep parts is more sluggish. Therefore we often see this sequela invade a very large area of the anterior surface of the eyeball, while the substratum remains almost intact. But where this sequela (owing to continuous harmful influences) does finally involve the deeper parts, it always involves the cornea much earlier than the sclera, since the conjunctiva is attached to the cornea with extremely short and firm cells, while it is attached to the sclera with long and very spongy cells. The more that the pterygium encroaches upon the cornea, the more seriously will vision be impaired; and the deeper that the pterygium penetrates, the more surely will degenerations follow. Certain vascular proliferations accompanying pterygium are to be regarded merely as an accidental complication. Here the ectasias never appear (as they do in pannus) first in the diseased spot; on the contrary, they always appear for the first time as the result of irritation, which every more edematous membrane immediately sets up in the ocular conjunctiva mechanically.

Article 32.

b) Ulcerations of the scleral conjunctiva.

When the scleral conjunctiva, in palpebral trachoma of long standing, suffers sympathetic inflammation (36) so that its vascular ramifications, without extending beyond the cornea, converge in some spots to form larger bundles, the result is that sooner or later the middle portion of each smaller bundle is elevated to form a small phlyctena. These phlyctenae always develop only in small numbers, like the larger bundles of vessels preceding them; usually just one forms at once, and it is rare to see two or three of them in an eye at the same time. They are located either close to the cornea or midway between it and the edge of the palpebral conjunctiva, never any closer to the latter. Each phlyctena which has developed in the manner described leaves behind it, after bursting, a flat yellow ulcer surrounded by small crimson vessels. If the disease is not properly checked at this time, it spreads farther; consequently the peripheral vascular network becomes more widespread, and the lardaceous bottom of the ulcer is often so swollen that it looks like the surface of a fairly wide cone truncated close to its base. That yellow focus becomes as large as a lentil, usually without any further manifestations. But where the focus reaches the abovementioned size with a simultaneous proportional extension of the circle of vessels, the whole conjunctiva always suffers sympathetic inflammation. If, in the latter circumstances, the ulcer is not likewise checked by proper treatment, the patient is threatened with all the dire effects which, in general, are to be dreaded in any more serious supporative inflammation of the eye. Destructive ulceration now prevails in the sides and in the deep parts, frank chemosis sets in, hypopyon follows, and in this way the patient may still lose his whole eye although the real trachoma is long since safely over.

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(36) See Article 31, section aa).

Chapter III. Sequelae affecting the cornea.

Article 33.

The portion of conjunctiva which serves as external covering of the cornea is very similar to it as regards its firmer tissue. Because of that fact and because both parts of the organ are intimately connected, they both suffer almost the same sequelae. Owing to the direct connection between the conjunctival membrane and the scleral conjunctiva, all sequelae of trachoma naturally affect the conjunctival membrane earlier than the corneal layers; yet, with reference to the nature of the anomaly, this difference is so slight that any distinctions based on it would be entirely unnecessary and artificial. In proportion as the tissue of the conjunctival membrane and corneal lamellae becomes thicker, they lose the mucosal nature of the portion of conjunctiva which belongs to the eyelids; not only in general, but in the same proportion, they suffer also a decrease in vitality and consequently in more active and more energetic metabolism. If we understand the full significance of those characteristics of the conjunctival membrane and of the cornea, we understand why these parts of the eye offer the most stubborn resistance to trachoma, and why, once they become affected, their cure is usually a very difficult matter and always a very slow process.

Article 34.

a) Corneal opacities.

The above corneal diseases, which form a separate entity and are more or less independent of eye diseases elsewhere, can result from any stage of development of trachoma. They are all the more certain to result if the discharge of mucus has spread from the eyelids over the ocular conjunctiva for a greater extent and for a longer period. Therefore watering seldom causes these sequelae, the discharge of pus is their most frequent cause. Sometimes corneal spots appear, over the whole extent subject to them, right during the primary disease. But usually the fastigium of trachoma merely paves the way for these sequelae. All the differences in location, degree of extent, and degree of intensity presented by corneal opacities are (since they have long since been thoroughly studied) too well known to deserve mention here. I shall, on the contrary, give a much more detailed account of all the modifications related to the nature of the disease which determine its course. Sometimes the disease takes the form of an isolated blennorrhea with the cornea as its focus. Sometimes the disease takes the form of insidious corneal inflammation extending to different points. Sometimes the disease takes the form of a mere vestige of a process that has come to an end. I shall do so because it is precisely these circumstances which, in spite of their importance for the treatment, have up to the present received far too little attention.

Article 35.

aa) Corneal opacities due to trachoma.

Of all corneal opacities, the commonest are the blennorrheal ones, following the discharge of mucus from the eye. At first we see them as small dots which are dull, lacking in luster, usually without any vessels, gray, always accompanied by marked photophobia, by a strong tendency toward lacrimation, and by a dirty-looking appearance (37) of the scleral conjunctiva. They inevitably become increasingly large as time goes on. Accordingly they project from the corneal surface and, when viewed with the loupe, are seen to be composed of small individual elevations which are pressed close together, are extremely fine, round, and semi-transparent. These very delicate projections greatly resemble the papillae which protrude from the scleral conjunctiva during the discharge of pus. But they differ from such papillae in two respects: partly because, as single projections arising in the thickest tissue, their scope is very limited; partly because they have developed from the bloodless, completely pellucid tissue of the cornea and therefore their dirty gray appearance makes them stand out against the clear cornea.

Greater development of opacities in trachoma will mean greater growth of the elevations described. Vice versa, those elevations will disappear more strikingly in direct proportion as the trachoma nears its end. The sequelae of trachoma vary with its intensity and extent. If trachoma, in its early stages, involves merely the conjunctival membrane, it can often be checked to such an extent that not a trace of the disease remains. But if trachoma, although only moderately advanced, penetrates all the corneal lamellae, it deprives thme of their power of resistance in some parts or in all parts; as a result, sooner or later these lamellae cannot withstand the pressure of the ocular fluids and they protrude until they form some variety of staphyloma (38).

Where the aforementioned very circumscribed anomaly of vegetation increases a great deal and is followed by gray white spots, it results in adynamic opacities which, in proportion to their size, either impair the sight or destroy it. Lastly, in the cases in which corneal opacities due to trachoma reach their greatest intensity and extent, long after the crisis of the primary disease has been successfully passed, these opacities may still destroy the eye by causing bursting of the eyeball (39).

Article 36.

bb) Corneal opacities due to inflammation.

Corneal spots due to inflammation take the form of dark gray specks resembling dust and surrounded by many blood vessels running toward the non-transparent region. As soon as those symptoms appear, patients complain of an annoying pain in the cornea and of increased sensitiveness in the whole eyeball. In this sequela the sclera always turns pale red, owing to mild vascular edema, which is hardly noticeable with the naked eye. The milder forms of inflammatory corneal opacities sometimes remain unchanged for a long time; the advanced forms, on the contrary, soon begin to undergo a great change. In the former case, if the inflammation is on the decrease, its attendant symptoms either disappear altogether, or its concomitant opacity is reduced only so far as to become adynamic (40). In the latter case, where the inflammation is on the increase and definite changes in form occur, the opacity becomes elevated to a conspicuous degree and causes sharp pains (even before it gains much ground); shortly afterwards the opacity is traversed by numerous small vessels, it becomes more or less bloodshot, and hereupon rapidly degenerates into a staphyloma (41) or even suffers abscess formation (42).

(37) See Articles 4 and 10.
(38) See Article 39.
(39) See Article 17.
(40) See Article 37.
(41) See Article 40.
(42) See Article 42.

Article 37.

cc) Adynamic corneal opacities.

Adynamic corneal opacities are generally found to be simply vestiges of s disease that has already come to an end. Lymph is usually responsible for this sequela; the lymph is over-oxidized, deposited in the corneal parenchyma, and hinders normal resorption processes. The opacities vary in size and color; they are vestiges of blennorrheal (43), inflammatory (44), and ulcerative (45) diseases of the cornea. They are characterized by the following symptoms:

the pathologic area gives every indication of a firmer structure which neither has fine granulations (46) nor is traversed by blood vessels (47);

without exception we find that the portion of conjunctival membrane which covers the opacity is lustrous and smooth;

the scleral conjunctiva likewise has its normal white appearance and is not at all dirty-looking - as in blennorrheal opacities (48) -, or pink - as in inflammatory opacities (49);

here the whole eye is always seen to be free from all other sequelae; in other words, here there is no tendency toward lacrimation in the presence of cold or of strong light, and patients never complain of photophobia or of any annoying feeling in the eyeball.

When we meet with this combination of symptoms, we may be sure that the opacities present are purely adynamic, and they will never very in extent or intensity.

Article 38.

b) Corneal staphyloma.

These sequelae always result from the more advanced forms of blennorrheal or inflammatory corneal opacities. If staphylomata are caused by the abovementioned blennorrheal anomaly, they develop by simple extension of the cornea. If they are caused by inflammation, however, they develop only after previous intimate union of the cornea with the iris. I shall henceforth refer to the first type of corneal staphyloma as extension staphyloma, and to the second type as adhesion staphyloma.

Article 39.

aa) Extension staphyloma.

This sequela arises from blennorrheal corneal opacities which do not reach a high degree of intensity but which cover a wide extent (50). If the blennorrhea (which impairs the cohesion of the whole texture without being able to develop far enough (51) to destroy the state of continuity) penetrates all the lamellae, the cornea, deprived of its resistance, turns into a staphyloma (owing to the pressure of the ocular fluids). At first, in such ectasias, we note that the cornea presents all the symptoms, and that the rest of the eye presents all the sympathetic reactions, which are generally present during the mild forms of blennorrheal opac-

(43) See Article 35.
(44) See Article 36.
(45) See Articles 41-43.
(46) See Article 35.
(47) See Article 36.
(48) See Article 35.
(49) See Article 36.
(50) See Article 35.
(51) See Article 35.

ities (52). Later on, when the abovementioned anomaly of vegetation in the cornea has come to an end, the opacity decreases a great deal, often enough for the diseased part to regain its pellucidity almost completely. This staphyloma is always found to continue growing as long as the blennorrheal secretion keeps up in the corneal layers. When this secretion has stopped, the staphyloma remains as a separate and distinct entity in many cases, but by no means in all. If the diseased tissue has already lost too much of its firmness, increasingly large masses of the aqueous humor and vitreous humor press against it from behind, even when no trace of the blennorrhea in question remains. Often the eyesight is in no wise impaired by small pellucid extension staphylomata; at most they make the patient a little nearsighted. Larger staphylomata, however, are always followed by total blindness, in spite of the fact that here the eye is almost wholly free from opacities. At the fastigium of the disease the staphyloma protrudes between the eyelids so far that they can no longer close over it. Here the staphyloma, if it does not receive attention at an early date, usually undergoes malignant, incurable degeneration.

Since extension staphylomata resemble the subsequent blennorrhea of the iris (53) and hydrophthalmus (54), I feel obliged, in conclusion, to discuss further how the latter conditions differ from the former anomaly. -

The clinical picture of every type of blennorrhea of the iris is as follows: there are special anomalies of sensation wholly peculiar to it (55); also, the original, merely hydrorrheal secretion which has accumulated under the cornea is first transformed into mucus, and shortly afterwards into pus; last but not least, such discharges are very liable to make the eyeball actually burst. Extension staphylomata, on the contrary, always start from a blennorrheal corneal opacity; they by no means cause qualitative changes in the aqueous humor; in their early stages they exist without injuring the general vitality and never terminate in bursting; in unfavorable cases, however, they gradually end in carcinomatous degeneration. -

As for hydrophthalmus, the difference between it and extension staphyloma is shown by the following comparison. In hydrophthalmus the corneal tissue always remains clear; in it the disease, preceded by amaurosis, plainly emanates from the depth of the eye and from the central vascular system (56); in it the increased accumulation (which chemically is always homogeneous) is the cause, and the enlargement of the cornea is the effect. During extension staphyloma, in contrast, the cornea always appears cloudy at the outset, and during this secondary disease an increase in the aqueous humor is plainly seen to be the result of insufficient resistance on the part of the corneal lamellae; the latter, owing to slight pressure, are likewise favorable to the secretory process when they thus place the process of resorption deeper; during this sequela, at first the eyesight is affected very little if at all; here the exact opposite of hydrophthalmus takes place, for the increased accumulation is plainly the effect and the corneal deformity the cause.

Article 40.

bb) Adhesion staphyloma.

The effect of inflammatory corneal opacities (57) which penetrate to the in-

(52) See Article 35.
(53) See Article 47.
(54) See Article 52.
(55) See Article 47.
(56) See Article 52.
(57) See Article 36.

ner lamellae varies with their intensity; thus, the cornea and the iris sometimes grow together purely at the surface, and at other times throughout their thickness. Adhesions at the surface are followed by so-called synechias of the iris; the proper place for a discussion of the latter is in connection with the other sequelae affecting the iris. In adhesions extending deep down, on the contrary, the resulting organic fusion is such that both these membranes are intimately intermingled, and that the portion of the cornea deprived of its individuality in this way is no longer firm enough. Consequently the ocular fluids force the inflamed tissue farther and farther forward, until it forms a truncated cone which is entirely opaque, violet gray or blue gray. -

In the presence of every incomplete staphyloma which has developed in the manner described, we always find that vision suffers from lacerations of the pupil, but we seldom find total blindness. Where the staphylomata cover the entire cornea (since the whole iris has been pushed forward and is intimately attached to the cornea), they always cause complete destruction of the anterior chamber accompanied by total loss of sight. -

Simple adhesion staphylomata are found only in the following conditions: where, soon after the cornea has been pushed forward, all signs of the inflammatory corneal opacities disappear; where, immediately afterwards, the anomalies of sensation cease; where all anomalous vascular ramifications regress; and where the cornea regains stronger powers of resistance within a short time, thanks to the organic functioning of the excretory portions of its fibers.

Compound adhesion staphylomata result when the abovementioned inflammatory process does not quite cease after the cornea has been pushed forward. Here the inflammation continues to sap the vitality of the diseased corneal tissue; here, while the external manifestations of the disease diminish, the inflammation insidiously spreads to the depth of the eye. Such a condition, so injurious from every viewpoint, can be recognized by: constantly increasing convexity of the cornea; deep orbital pains; occasional, recurrent, transitory stabbing pains in the eyeball; and continuous, abnormal sensitiveness of the whole eye. -

In general, the outcome of adhesion staphylomata varies with the severity of the abovementioned types. Simple, incomplete staphylomata often leave the general vitality quite unimpaired, unless some fresh cause intervenes. Complete staphylomata practically never do so; since they offer but feeble resistance to the pressure of the aqueous humor and vitreous humor, they usually extend, sooner or later, to the part of the sclera adjoining the edge of the cornea, at all points of the periphery simultaneously. The entire staphyloma, whose growth is promoted, than always becomes round and almost spherical in shape. In these circumstances, if in time it becomes so large that the eyelids can no longer close over it, it undergoes degeneration and sets up continual harmful irritations increasing progressively, until all the ocular membranes gradually suffer cancer. The third variety of adhesion staphyloma (the one which combines all the previously mentioned features of the complication) is the one most to be dreaded. Whether the presence of such staphylomata be incomplete or complete, they are transformed (with sudden swiftness, as a rule) into unmistakable, highly malignant carcinomata; the latter (unless bold steps are taken at an early date) threaten not merely the whole eye but also the patient's very life.

Article 41.

c) Corneal ulcers.

Corneal ulcers which follow trachoma are by no means always limited to one variety. Many form at the center when the corneal inflammation is incomplete; others appear to be caused by excessive resorption alone, without a trace of inflammation. My next articles will be devoted to these two varieties of this sequela; however, I shall not discuss the well known general modifications in form and extent which they have in common with other ulcerations.

Article 42.

aa) Corneal ulcers due to inflammation.

This anomaly always develops from inflammatory opacities of the cornea (58). If these are traversed by a profusion of vessels (when the corneal parenchyma involved turns red) and pushed forward to form a mound, and if their tips are filled with yellowish fluid while sharp pains appear, they turn into genuine ulcers through bursting of the pustules. Depending on whether the ulcers (which have originated as described) become productive or destructive, they evince different reactions.

The following conditions signify productive ulcers: all manifestations peculiar to inflammatory corneal opacities which were present prior to the appearance of pus gradually abate right after the latter; furthermore, many small red specks make their appearance in the yellowish base of the ulcer; lastly, the levelled edges progressively recede toward the center of the excavation. Usually the disease stops at this point, and is very soon followed by a small leukomatous cicatrix covering the space occupied by the ulceration.

Where the more malignant variety occurs, where the ulcer tends to be destructive right from the outset, the following conditions, on the contrary, prevail: immediately after bursting of the pustule, the base of the ulcer becomes dirty gray, sometimes entirely lardaceous; the edges become very edematous; the inflammation surrounding the focus of pus peripherally increases in extent as well as in intensity. Such ulcerations do not increase much in width, but at an early date they extend downward so far that even the internal coat of the cornea cannot long withstand them. If these secondary diseases penetrate by means of a small opening, they give rise to true collections of pus in the anterior chamber; yet such collections are usually slow to form. In the case of larger ulcers, the aqueous humor at once escapes and the iris approaches the diseased part of the cornea. Where a smaller perforating corneal fistula comes to a standstill even before the iris and the edge of the ulcer come into contact, or where such contacts were of short duration at first, the purulent secretion is often absorbed again and the opening is closed by means of a small chalk white scar without distorting the pupil. In such corneal ulcerations, when that contact lasts until the iris adheres to the inflamed corona of the ulcer, a black speck surrounded by gray is always left behind and is accompanied by distortions of the pupil. If the ulceration does not stop even after the iris has come into contact with the cornea and if the iris is pushed forward to form a mound, the eye can still be destroyed in toto either by staphyloma of the iris or by general suppuration, even if the trachoma is long since safely over.

Article 43.

bb) Corneal ulcers due to resorption.

These ulcers are differentiated from corneal ulcers due to inflammation by two features: the tissue presents no opacity, and there is no inflammation. They often appear right during the fastigium of trachoma; but sometimes, too, they appear much later, when the cornea is unusually bright in spots, clear, smooth, and shining (59).

(58) See Article 36.

(59) See Article 16.

As long as these ulcerations are progressive, they cause severe photophobia and create the impression of small particles punched out of the cornea cleanly and also in very irregular shapes. A standstill is reached when the disease is accompanied merely by the milder forms of the anomaly of sensation just mentioned. The process is nearing its end when, as the photophobia continues to diminish, the periphery of the ulcerous excavation becomes smaller and smaller. One very characteristic, pathognomonic criterion in this disease is the conspicuous loss of corneal substance; this loss occurs without visible destruction by pus or gangrene. If the loss of substance occurs in neither of the two ways mentioned, it can take place solely through excessive resorption; hence abnormally increased absorption must, in the main, be the explanation. Probably that abnormality results because the overdevelopment of productive power (which during severe trachoma is seated in the eyelids) swings to the opposite extreme; thereupon that power suffers a loss and likewise causes a proportional predominance of the power of absorption inside the conjunctival membrane.

The effects of these anomalies vary in proportion to their mildness or severity. If the ulcer heals before it penetrates from the conjunctival membrane to the innermost corneal lamella, it is followed simply by small scars; the latter are not in the least opaque but perfectly transparent, and usually somewhat excavated. Where several ulcers of the same kind affect the eye, the subsequent respective excavations always look like facets here and there upon the cornea, as it were. Where the innermost lamella is perforated by a small opening, we must, if the healing is slow, expect the same untoward effects which result from inflammatory ulcerations in similar circumstances (60). There are two good reasons why the untoward effects of ulcers due to inflammation usually appear much sooner than those of ulcers due to resorption: as previously described, the inflammatory process, closely connected with the former, makes the cornea constantly a prey to adhesions; similarly, this enforced organic adhesion in the latter first develops gradually, through the irritation which is set up in the protruding portions of the iris partly as the result of anomalous situation and partly as the result of atmospheric influences. As soon as resorptive ulcers perforate the cornea right at the outset (by means of a few very large openings or many small ones), they are inevitably followed (even when proper treatment has been administered) in some cases by distortions of the pupil, and in other cases by an independent staphyloma of the iris which becomes enormous (61).

Chapter IV. Sequelae affecting the iris.

Article 44.

There are many varieties of sequelae of trachoma affecting the iris. They originate in three ways: sometimes those processes which produce corneal inflammatory opacities at the site where the iris (owing to its greater circumference) joins the cornea and sclera continue downward; next, in perforating corneal ulcers, the iris is often in part pushed forward through the anterior chamber; and lastly, too, the tissue of the iris (because it abounds in very spongy cells) tends above all to promote all blennorrheas which are trying to reach the inside of the eye. The first cause results in characteristic synechias, the second in definite varieties of staphyloma, and the third in subsequent blennorrheas of the iris. The details of these various sequelae are discussed in the articles which follow.

(60) See Article 42.

(61) See Article 46.

Article 45.

a) Synechia of the iris.

All synechias of the iris following trachoma develop from corneal opacities due to inflammation (62). They are likely to appear where the disease which is peculiar to the corneal defects just mentioned spreads from the region of the cornea to the ciliary ring of the iris. Such an encroachment is to be feared: when the eye, during inflammations of the kind described, becomes much more sensitive; when the pain goes deeper; when the photophobia increases; when the iris consequently becomes dirty red in a sharply defined area not far from the ciliary margin; and when the iris at the same time swells up at the abnormally colored spot.

In other words, if in these circumstances the swollen part of the iris remains in contact with the cornea for a fairly long time, and if the anomaly does not advance further and produce intimate fusion of those membranes (63) or purulent destruction of those membranes, the surfaces of the diseased membranes facing each other grow together wherever inflammation is present. When the inflammation has died away, only the adhesion of the surfaces remains; it is not followed by further dynamic changes. Since these synechias are the result of inflammation (originally confined to the cornea, and only later extending further into the contiguous parts), we usually find them close to the ciliary ring, and we always find concomitant opacity of the cornea. If these synechias are of limited extent, they cause minor distortions of the pupil which impair the function of the eye little if at all. On the contrary, every synechia which is similar in nature but somewhat larger elongates the pupil toward the adhesion, thereby creating visual disturbances; the latter are all the more severe if vision is further obstructed by the concomitant corneal opacity at the remaining normal part. If the synechia has a large circumference, if it extends from the ciliary ring of the iris up to the edge of the pupil, the eye may become almost totally useless, since then the abovementioned untoward effects reach their maximum.

Article 46.

b) Staphyloma of the iris.

This sequela arises when the part of the iris suffering from corneal ulcers adheres to the edges of the abnormal perforation (64). What serves to distinguish this sequela very clearly from other staphylomata (65) is that it creates sharply defined, soft, violet black hernias - usually spherical - which protrude from the cornea. Protrusions of the iris are progressive as long as, during continued corneal ulceration, they remain dusty-looking, dull, without luster, and soft. The disease has come to an end, on the contrary, where all symptoms peculiar to ulcers disappear, and where the staphylomatous hernias are covered with a very thin but nevertheless firm membrane which is very shiny and replaces the loss of corneal substance, as it were.

At first every staphyloma of the iris usually looks very small and not unlike the head of a fly; in these circumstances it is given the name of myiocephalon. When a staphyloma of the iris is larger it is termed helos [head of a nail], and when it becomes so large that the eyelids cannot close over the eye it is called melon. A single staphyloma of the iris (if small) which is at a distance from the pupil can with proper care be destroyed, often saving the sight. Only when the

(62) See Article 36.
(63) See Article 40.
(64) See Articles 41-43.
(65) See Articles 39-40.

growth of such staphylomata is not checked at an early date, or when they are situated very close to the pupil, do they lead to serious distortions - even to total loss of sight -, and actually to destruction of the eye if unfavorable conditions prevail. Compound staphylomata of the iris (protruding through several perforations in the cornea) cannot exist without deforming the cornea and the iris in various ways; therefore they have very serious consequences from their very beginning. Even if all measures to remove them are taken at an early date, only the form of the eye is preserved at most; there is no hope of preserving the use of the eye. Unless the greatest care is taken by the physician in treating them right from the beginning, their confluence causes grape-like tumors known by the name of racemose staphylomata, which sooner or later destroy the entire eyeball.

Article 47.

c) Subsequent blennorrhea of the iris.

This condition, which often appears long after the fastigium of trachoma, results when ocular blennorrhea penetrates from the surface to the deep parts, when it penetrates from the cellular stroma of the conjunctiva to the cellular stroma of the iris. This takes place in two ways: either the iris reacts sympathetically, owing to propagation of the anomaly, in such a way that the process - which has reached the cornea and is constantly advancing farther into the tissue - does not leave the adjacent ciliary ring uninjured; or the iris becomes involved (in accordance with the law of metastasis) when as the blennorrhea is transported to it, even without that advance into the tissue. It is to be noted that the abnormal fluid which is produced in internal blennorrheas probably issues from the posterior surface of the iris first. At least this would be indicated by several facts: in part, by the obviously increased productivity of the uvea, as evidenced by the deposit of pigment; in part, by its velvety texture far exceeding the anterior surface in sponginess; and, lastly, by the fact that purulent secretions always flow outward from the posterior chamber first and through the pupil into the anterior chamber of the eye. Blennorrheas of the iris are evidenced by different symptoms depending on their different evolution.

Symptoms of their stage of watering are: increased sensitiveness of the eye; boring pain; transitory sharp pains sometimes affecting the whole region of the eye; increased photophobia, more marked tearing, and edema of the iris of some magnitude; greater convexity of the cornea, and enlargement of the anterior chamber, which is filled to overflowing with clear serous fluid.

If the period of discharge of mucus (66) sets in, the aqueous humor becomes noticeably cloudy and individual grayish white fine flakes of mucus are discovered throughout the anterior chamber, but principally in the pupil.

Where internal discharge of pus takes place sooner or later (sometimes within a few hours, sometimes not until several days after the latter symptoms), purulent yellowish white lymph is suddenly discharged from the eye, in the presence of serious visual disturbances. This discharge does not cause pallor of the iris, contraction of the pupil, or shrinking of the anterior chamber. In short, it is not accompanied by any symptoms which essentially characterize pure iritis. At first, when chronic, it results in small collections at the lower segment of the cornea, owing to a small trickle (plainly visible) over the lower edge of the pupil; later on, the pus fills the entire anterior chamber.

As for the consequences of blennorrhea of the iris, we can be fairly sure of preserving the function and the form of the eye only in the stage of watering and the stage of discharge of mucus. The shape of the eyeball is quite often preserved

(66) See Article 9.

after the secretion of pus, to be sure, but the sight is very seldom saved. When serious cases of internal discharge of pus go untreated, usually they soon end in total destruction of the eye, owing to bursting of the eyeball (67).

Chapter V. Sequelae affecting the lens and the vitreous.

Article 48.

Just as discharges of mucus from the eyelid set up sympathetic inflammation in the scleral conjunctiva (68), the more advanced forms of blennorrhea readily set up analogous sympathetic reactions in the internal transparent membranes. Where, owing to this condition, sufficiently independent inflammation takes place merely in the adjacent lens system, it causes opacities of the lens and of the lens capsule. When the inflammation in the structures just mentioned has come to a speedy end and violently attacks the vitreous humor, the latter becomes entirely opaque. Finally, if both the lens and the vitreous suffer the same degree of inflammation internally, both become opaque in the same way. The condition mentioned gives rise to cataract in the first instance, to simple glaucoma in the second instance, and to cataract plus glaucoma in the third instance. Therefore, because these sequelae always result solely from the most serious inroads (definite actions) of trachoma, since every more intensive propagation brings about internal blennorrheas much earlier (69), cataract and glaucoma are generally much rarer after ocular blennorrheas than after pure inflammations of the eye.

It is worth noting that these varieties of opacity arise not only when ocular blennorrhea is acute but also when it is chronic. In all persons in whom the blennorrhea spread inflammation to the inner parts right during its fastigium, those opacities coincided with its decrease. Acute blennorrhea came safely to an end without affecting the transparent media in any way, whereas the chronic form gradually caused reflexes penetrating deeper; hence cataract and glaucoma appeared at a late date, often not until long years after the fastigium of trachoma. The scope of this work does not permit further discussion of both these diseases, which are a matter of common knowledge and have recently been very thoroughly studies.

Chapter VI. Sequelae affecting the retina.

Article 49.

Every form of secretion - even the mildest form - is always accompanied by a corresponding involvement of the nervous system. In the ocular blennorrheas, such an involvement of the nerves of the eye is evidenced by various symptoms, in other words, by sequelae. Even during the early stages of trachoma patients constantly complain of itching of the eyelids and of marked photophobia (70). In the later stages of blennorrhea there are transitory sharp pains in the entire region of the eye, increased sensitiveness to being touched, and considerable photophobia (71). The fastigium of the disease is accompanied by a distressing feeling of heat in the eye, by the sensation of a red-hot coal deep in the orbit, by excruciating photophobia, by scotomata, and often also by true photopsia (72). Should those nervous manifestations (as the result of more acute affections) involve the diseased organ

(67) See Article 17.
(68) See Articles 4, 10, 16, 30, 31, 33, 36.
(69) See Article 47.
(70) See Article 5.
(71) See Article 11.
(72) See Article 20.

so deeply that when trachoma is over they remain as an entity, more active or less active than normally, they are inevitably transformed into either secondary photophobia or into true amaurosis which is more or less complete.

Article 50.

a) Secondary photophobia.

Here we are concerned not with that increased sensitiveness to light which is caused by various other primary and secondary eye diseases, but with the photophobia which remains as a disease sui generis after trachoma. Any photophobia which has originated in the manner described is distinguished from simple photophobia having some other cause by the fact that it is always accompanied by itching of the eyelids. Both anomalies of sensation are intimately connected even in the stage of watering; hence the two are likewise inseparable when they form a sequela of trachoma.

The mildest form of secondary photophobia (in which patients see without difficulty in the dim light on an overcast day, and complain of ocular pain only in the sunshine or when looking at brilliantly illuminated objects) is of course found after every attack of trachoma, no matter how slight the attack, but in favorable conditions it usually disappears of itself within a few weeks.

Where secondary photophobias reach the middle stage, the eye can no longer be opened in dim light without pains and marked tearing, and patients are comfortable only when remaining in the semi-darkness of twilight; these photophobias do not often occur, as a rule, but when they do they always last for several months and they almost never abate unless treated.

When secondary photophobia reaches its maximum development, even the semi-darkness of twilight is dazzling; here the pupil, even at every attempt to open the eyelids wide in the shade, hides behind them; when such over-activity is present, patients still shade their tightly closed eye with their hand in the daytime, since in these circumstances even the small amount of light which filters through the eyelids to the inside is quite sufficient to cause pain. Here the disease resists the most powerful drugs for a long time; here, when improperly treated, it has a marked tendency - alternating with chromatopsia and photopsia - to develop into genuine amaurosis.

Article 51.

b) Amaurosis.

This sequela of trachoma appears in its two forms pointed out by Schmidt (73) and by Kieser (74).

One variety, which I should like to term erethistic amaurosis, is to be feared chiefly where anomalies of sensation during trachoma are strikingly predominant over all the other pathologic symptoms. It is the variety in which the vigor of the retina is much greater than that of the choroid, in which nervous activity is increased with a corresponding restriction of vascular activity, in which spontaneous photopsia makes vision impossible. Usually it has developed from stubborn secondary photophobia, alternating with chromatopsia and photopsia (75). Almost without exception, it next takes the form of amblyopia erethica (in which patients find it hard to distinguish smaller and larger objects, owing to perpetual excessive photophobia); and then it appears as complete erethistic amaurosis, where a sheet of light constantly floats before the eye and vision is lost.

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(73) See the article by Joh. Adam Schmidt, "Reihen von Krankheitsformen deren Substrat die Conjunctiva des menschlichen Auges ist. C. Drittes Glied [xxxxx] Augenlied-Tripper", in Ophthalmologische Bibliothek, volume 3, pages 107-152, number 2, 1805-1807.

(74) See Kieser, l. c.

(75) See Article 50.

The opposite variety is properly designated by the name of torpid amaurosis. In it the retina is less active than the choroid, nervous activity is restricted by very marked vascular fluctuations, and vision suffers from a lack of sensitiveness to light. It appears principally when anomalous secretions in trachoma predominate over the other pathologic symptoms out of all proportion. During blennorrheal secretions the whole vascular system of the eye always becomes more active, in order to transport the necessary material; consequently the choroid (composed almost purely of vessels) can show sympathetic reaction to an excessive extent, which reaction never again wholly subsides.

If this sympathetic reaction remains quite mild, it gives rise to torpid amblyopia, in which patients perceive objects of all kinds only incompletely, owing to hazy vision. Where this reaction does not remain mild but becomes more and more severe, it is followed by completely independent torpid amaurosis, accompanied by scotomata; here everything in front of the eye appears pitch black and all vision is lost.

The following facts regarding the time required for amaurosis to develop deserve consideration. The abovementioned erethistic anomalies, when genuine, seldom develop rapidly; but, once they are well established, they are almost never of long duration because (the activity of the retina, having been strained, is weakened) they usually turn into the opposite variety in several weeks or months.

Torpid amaurosis is more variable as regards the course of its development. It has a protracted course when trachoma is mild and lasts for several years; here the onset of this visual defect is insidious, so gradual as to be hardly perceptible, and often so occult that we have no inkling as to when the disease actually starts. This form of amaurosis has a much swifter course when it results rather from very copious secretions than from continuous moderate secretions. This disease is most shortlived after sudden termination of trachoma; in other words, the blood vessels of the eye (owing to the more copious secretion of incremental materials accompanying every conjunctival disease involving discharge of mucus) undergo marked stimulation at first. And, if the external accumulation comes to a sudden end without sudden changes elsewhere, the vascular activity inside the choroid becomes so great that the function of the eye is entirely lost in a few days - even in a few hours - without going through any stage of amblyopia. In view of this fact, torpid amaurosis is not seldom a sequela of trachoma, owing to improper application of cold to the eye, owing to the abuse of astringents externally, and owing to the improper treatment of fungous ectropion.

Chapter VII. Sequelae affectinf the central vascular system of the eye.

Article 52.

Hydrophthalmus and atrophia bulbi.

As regards symptoms and outcome, hydrophthalmus and atrophy of the eyeball resulting from trachoma and always associated with visual defects took place wholly in accordance with the explanations already given of them. The only aspects left to discuss somewhat further here are their nature and genesis.

It is evident from what follows that the nature of the secondary diseases mentioned consists in pathologic activity of the central vascular system. If we consider the course of the central artery and its ramifications in the cells of the vitreous, and all ramifications of this artery up to the ocular chambers in embryos and adults, it is perfectly obvious that this system pre-eminently supplies nourishment to the transparent media. Although the eye has several other important series of vessels besides the central artery and vein, the former serve a totally different purpose. The chief purpose of the choroidal vessels (76) seems to be to offer antagonism to the retina (the function of vision), and that of the ciliary vessels (77) seems to be to offer antagonism to the ciliary nerves (the internal movements of the eye).

Now, if the status of nutrition of the ocular fluids accordingly depends mainly on the central vessels, the deformities resulting from increased or decreased filling of the eyeball must of necessity likewise depend on the degree of activity of those vessels. There are two reasons why trachoma produces conditions in the central vascular system which sometimes lead to hydrophthalmus and sometimes lead to atrophy of the eye. On the one hand, more severe trachoma promotes greater fluctuations in every vascular system of the eye, owing to the higher productivity associated with it (78); on the other hand, such trachoma can diminish the force of those organs of vegetation considerably, owing to excessive secretion taking place externally, Both these diametrically opposed effects are followed by a change in the volume of the eyeball which continues independently only where these effects are more pronounced. These anomalies of quantity of the ocular fluids do not always, moreover, develop to exactly the same extent in all parts of the eyeball.

If the increase or decrease in the activity present is confined entirely to the anterior ramifications of the central artery which extend to the ocular chambers, the increase causes anterior hydrophthalmus with manifest ectasia of the cornea, and the decrease causes a rutidosis associated with manifest diminution of the ocular chambers.

Where, on the contrary, it is rather the posterior branches of the central artery extending to the cells of the vitreous which suffer, socalled posterior hydrophthalmus (79) develops (with excessive fluctuation), and general atrophy of the eye develops (with subnormal activity).

Lastly, as regards the frequency of those secondary diseases, their pure form is seldom seen after trachoma because only more severe trachoma seriously affects the deep parts. Furthermore, trachoma is much more liable to cause organic defects of some description than actual changes in the central vessels.

(76) See Article 50.

(77) See the Article by C.F. Graefe in Archiv für die Physiologie (Reil), volume 9, pages 225-236, number 1, 1809.

(78) See Article 50.

(79) If there were definite confirmation of the findings of Jacobson regarding the special ocular fluid which he claims to have discovered between the choroid and the retina in the back of the eye, the pathologic increase in this fluid would be called hydrophthalmia posterior, and the condition which we have hitherto termed posterior hydrophthalmus would have to be indicated by the name of middle hydrophthalmus.
See the Article by L.L. Jacobson, "De humore oculi parvum cognito, atque de morbus e statu ejus anormali orindus", in Acta regiae Societatis medicae Havniensis, volume 6, pages 299-323, 1818-1821.

Book two. Nosology.

Article 53.

For purposes of classification of trachoma, I shall first group together the conclusions which, in this connection, are to be drawn from the sum total of the pathognomonic symptoms in general (80). I shall then discuss the variant forms of the process afforded by the definite characteristics, by the various complications, and by the difference in duration. Lastly, I shall study the degree of relationship of trachoma to other diseases of the eye.

Chapter I. The nature of trachoma.

Article 54.

a) The general relationship of inflammation to anomalies of vegetation.

Inflammation must be considered as the beginning and primum mobile of all pathologic change, as the cause of all local anomalies of vegetation. Inflammation exists in two forms: either pure (when it has only the attributes absolutely essential to its nature), or with a heterogeneous admixture. In the first instance this anomaly appears as a purely homogeneous process; in the second instance it is seen to be associated with a non-inflammatory element which acts as a deterrent on its free development, and on account of which it takes on the character of a mixed disease (81). Each separate non-inflammatory element produces a correspondingly different variety of mixed inflammation.

Article 55.

b) Trachoma belongs among those mixed inflammations called blennorrheas.

Careful examination of the onset, the termination, and the sequelae of trachoma leaves no doubt in our minds that the process is an inflammatory one (the proof being the symptoms of increased temperature, increased sensitiveness, incipient redness and edema which are intimately associated with every stage of development). On the other hand, if these symptoms are not singled out from the others accidentally present at the same time, if all the component symptoms are included just as they are blended in trachoma, we shall see the following. The characteristic secretion (connected with every period of development, not having the requisites of pure inflammation, and commonly predominating over all symptoms) shows that trachoma belongs in general among mixed inflammations, and in particular among the anomalies termed blennorrhea (owing to the form of the complication) by several writers on nosography.

(80) See Articles 1-23.
(81) See the book by Philipp Franz von Walther, "Abhandlungen aus dem Gebiete der practischen Medicin, besonders der Chirurgie und Augenheilkunde", volume 1.
Landshut. 1810. Octavo size.
Especially page 359.
(82) See Article 61.

Article 56.

c) Internal basis of the blennorrheas.

The conspicuously abnormal secretion intimately associated with trachoma (on account of which, as I hope to point out in detail later on, true incremental fluids are elaborated, beyond peradventure) at once implies some particular internal cause (82). Further arguments in favor of the theory that this cause consists in faulty production, in some strange aberration of the formative impulse are (apart from that circumstance): the proliferation of connective tissue accompanying blennorrhea; and the tendency toward the formation of papillae which is never absent in blennorrhea.

We conclude that there is proliferation of the connective tissue because the part affected with disease during the blennorrheas succeeds in spreading out without the assistance of vascular propagations, internal exudations, or any other well known causes. Even in the lowest stage of development, watering, the process in question is evidenced by the edema of the palpebral conjunctiva. It is unmistakable in the discharge of mucus, as evidenced by edematous wrinkling and visible loss of cohesion of the peripheral portion of the scleral conjunctiva. It becomes most conspicuous during the stage of discharge of pus, where the protoplasm (from loss of cohesion as well as from material propagation) is seen to be so over-developed that the eyelids (which are both elastic and puffed up to the touch) covering the eyeball are almost the size of the fist (83).

The abovementioned tendency toward the formation of papillae is just as much in evidence as the abovementioned proliferation of the connective tissue is among the symptoms of blennorrhea. During watering (84) we see the beginnings of this metamorphosis in the lighter and darker dots strewn about, which are perceived with the loupe as extremely delicate and minute specks. During the discharge of mucus (85) this development is much more marked; here, namely, the fine granulations which have grown up can be detected even with the naked eye in the velvety texture of the diseased surface. We see the papillary bodies fully developed during the discharge of pus, where the granulous conjunctival surface (covered with countless perfectly round granulations, which lie close together) removes any doubts as to the nature of the disease (86).

The natural conclusion to be drawn, when the mechanism of the abnormal secretion mentioned and also the characteristics of the structural anomalies mentioned are taken together, is as follows: the internal basis of blennorrhea is constituted by predominant formation of cellular tissue combined with a tendency toward the formation of papillary bodies and with the secretion of a superabundant incremental material.

(82) See Article 61.
(83) See Articles 18 and 22.
(84) See Article 4.
(85) See Article 10.
(86) See Article 16.

Article 57.
d) Site and extent of blennorrhea in general.

If the blennorrheas result from a particular kind (87) of proliferation of the connective tissue (through over-development of protoplasm), we must look for the site of the disease in the part mentioned and nowhere else. All organs are composed of vessels, nerves, and protoplasm, all contain the soil upon which blennorrhea naturally thrives; but that is no reason why each of them should ipso facto give rise to the same degree of blennorrhea. In part this process requires loose cellular tissue with a greater tendency toward loss of cohesion; in part it requires such cellular tissue as promotes more active metabolism through greater power of secretion superposed on the original power of secretion. Now, the more that the cellular basis of the structure fulfils the two conditions stated, the greater does its susceptibility to blennorrheal diseases prove to be. -

Foremost in this connection are the mucous membranes and glands, unquestionably, since, in addition to having a wealth of loose cellular texture present even normally, they are designed for more active intake and excretion of incremental fluids. -

Next in order is the cellular tissue, between separate masses, which is exposed to the air; it is somewhat less inclined to be a prey to blennorrhea than the mucosae are because in it the metabolism is only sufficient to keep it alive. In spite of this fact, it is evident from what follows that the susceptibility to blennorrhea evinced by this tissue is far greater than that evinced by all more compact soft parts: blennorrheas penetrating deeper toward the muscles become widespread with extraordinary rapidity in that interstitial tissue, and yet they do not injure the invested parts in any way, at least not until much later. If one wished to explain this fact not by the presence of predisposition but purely by sinking of the anomalous secretion, it would be objected that the extensions of this disease often take place by rising, too, therefore in violation of the law of gravity. -

The corium and the serous membranes rank next in order to the cellular tissue exposed to the air, as regards susceptibility to the blennorrheas. Although both membranes are conspicuously endowed with a very active metabolism, they are so compact in structure that they suffer blennorrhea only after ensuing loss of cohesion on the part of the tissue. -

Fibrous organs display much less of a tendency toward blennorrhea. They are not at all adapted for secretion, and neither are they composed of loose cellular tissue. In these organs, furthermore, the resistance increases in direct proportion as they become increasingly tendinous through condensation. Consequently we often see pure muscle substance already altered, while tendons are found to be still uninjured in any way. -

The greatest immunity to blennorrhea is unquestionably possessed by the bones; they contain the firmest masses of cells, with deposits of lime, and consequently are least adapted for secretion. Consequently, after saline fluxes have penetrated far, extensive pyorrheas inside the soft parts of the lower extremities often last for years before the bone fibers are invaded by such a disease and are transformed into structures with elastic cells and pathologic secretions.

(87) See Article 56.

Article 58.

aa) Duration of blennorrhea in relation to the nature of the organs.

The less the form of structure of affected organs originally lends itself to blennorrhea, the more lasting are the changes which result from the blennorrheas once they have developed. Mucous membranes and glands, the parts which most readily suffer blennorrhea, are the first to return to normal, other things being equal. The cellular tissue exposed to the air in the course of the disease has greater difficulty in returning to normal. It is possible to free serous and fibrous organs affected with the blennorrheas from the anomaly only in very favorable circumstances. Bones, which become involved only when blennorrhea reaches its maximum, never regain their former quality, in proportion as the disease has invaded them.

Article 59.

bb) Final metamorphosis which the blennorrheas cause in each structure.

Since the blennorrheas cause the formation of papillary bodies, they necessarily act as a deterrent on all other relationships, on all other elements of the diseased organ. Because of this property, blennorrhea creates a manifest tendency toward a uniformity of structure in every part affected by it. Also, the more that the above property is augmented by more unimpeded and more advanced development of blennorrhea, the greater is the proportional loss if identity of the structure, the more is the resistance of the heterogeneous structures broken down, and the more intimately intermingled are the most different types of structure until they cannot be distinguished from one another. Mucous membranes, glands, cellular tissue exposed to the air, serous membranes, the corium together with its epidermis, muscles, tendons, and even cartilage and bone cease to be what they were. Thereupon they are jointly decomposed (as pyorrhea develops) into perfectly homogeneous cellular tissue whose sole aim is the formation of papillary bodies.

Article 60.

e) Course of blennorrhea in the eye.

Blennorrhea, when it enters and leaves every single part of the eye, likewise obeys the same laws according to which it affects certain structures rather than others (88).

The conjunctiva, the ocular membrane which has the loosest structure and is also best adapted for secretion, is more prone to blennorrhea than all the other ocular membranes are (89). Its palpebral portion is always the first to suffer, because (containing the Meibomian glands, consisting of mucous membrane primarily) it is particularly suited to the requirements of blennorrhea. Blennorrhea involves the scleral conjunctiva (which differs greatly from the mucous membranes by reason of its substratum of sinews and fibers) only when the process has reached a more advanced stage of development in the palpebral conjunctiva (90). Of all the parts of the conjunctiva, its center (the socalled conjunctival membrane) remains free from the blennorrheas longest, not only because of greater density but also because it is intimately connected with the firm tissue of the cornea and lies closer to the serous membranes than to the mucous membranes (91). -

(88) See Articles 57-59.
(89) See Article 4.
(90) See Article 10.
(91) See Article 16.

Where blennorrhea penetrates beyond the confines of the conjunctiva, the cornea or the iris soon gives way. This is because the cornea (not, however, owing to its texture, but owing to its intimate connection with the conjunctival membrane) is more susceptible to the blennorrheas, and because the iris (not, on the contrary, from its situation but from its extremely loose tissue) is particularly subject to blennorrhea (92).

The blennorrheas almost never advance to the innermost structures of the eyeball (hyaloid, retina, choroid, and sclera) before rhexis takes place, through greater development of the disease. Of these membranes, the sclera (manifestly composed of sinews and fibers) offers resistance to the force of the anomaly for the longest period. Sometimes, therefore, the eyeball is preserved (at least as regards the integrity of its form) even after the depth of the eye has suffered violence (93). If the pathologic process likewise destroys the cohesion of the sclera, the entire eyeball is transformed into a completely homogeneous cellular mass composed solely of papillae of flesh. In this way the organ having the greatest individuality is transformed into a lumpy stump which contains the simplest tissue having the least individuality, composed of papillary bodies alone (94).

Regressive blennorrhea obeys the aforementioned general laws (95) just as much as progressive blennorrhea does. Other things being equal, the disease departs most readily from the palpebral conjunctiva and scleral conjunctiva, from those parts of the conjunctiva which most readily become affected. The return to normal of the cornea and its conjunctival membrane is more difficult in direct proportion as they have longer withstood this disease (thanks to their firmer texture); consequently, almost without exception, they are left with indelible traces even after mild degrees of development. Lastly, the texture of the sclera (unquestionably the firmest and the least prone to blennorrhea), once its cohesion is destroyed by blennorrhea, loses its individuality beyond recall (96).

Article 61.
f) General status of the blennorrheal excretion.

Where the abnormally increased plastic force, as in the blennorrheas, reaches such a pitch that the diseased parenchyma cannot cope with the entire amount produced, two things happen. There is an outward flow of the incremental parts (which are reduced to a neutral state in the blood), whose immediate function is the self-preservation of the structures. We see them - sometimes as a manifestly gelatinous secretion, sometimes as a manifestly albuminous or fibrinous secretion - depart from the province of the diseased organ. The following statements will explain why those increments (which internally form one with the secreting part, and only externally are differentiated from it) are not always alike in nature when they escape.

According to Fourcroy, gelatin can be converted into albumin through absorption of oxygen, and by continued oxidation albumin can be converted into fibrin, into the form of albumin having the highest degree of solidification and consistency (97).

(92) See Article 17.
(93) See Article 17.
(94) See Article 17.
(95) See Article 58.
(96) See Articles 4, 10, 16, 17, 58.
(97) See Fourcroy and Vauquelin, 1. c., volume 10, pages 113-130, August, 1791. See the book by Philipp Franz von Walther, "Physiologie des Menschen mit durchgängiger Rücksicht auf die comparative Physiologie der Thiere", volume 1, pages 294-304. Landshut: Krüll. 1807-1808. 2 volumes. Octavo size.

According to my personal investigations, the serous fluid secreted during watering is composed of gelatin and of weak, rather de-oxidized albumin, such as is found in the blood serum. The mucus produced during the stage of discharge of mucus is partly composed of pure albumin and partly of much more highly oxidized albumin. The pale yellow purulent lymph which appears during the discharge of pus contains, in addition to the varieties of albumin just mentioned, fibrin (the most highly oxidized albumin); because fibrin is not water-soluble it gives this lymph its characteristic emulsive, opaque appearance. Now, it is true that gelatin, albumin, and fibrin differ from one another only by their relative degree of oxidation, and that (according to the above discussion) we find these incremental ingredients little oxidized in watering, more highly oxidized in the discharge of mucus, and most highly oxidized in the discharge of pus. Therefore it is extremely probable that the different forms in which those elementary products escape depend wholly on an ever-increasing intensity of oxidation, commensurate with these respective stages of development.

Another of the essential properties of these secretions (in addition to the ones already mentioned) is that they are a reliable index to actual structural change produced in the affected organ. In other words, just as the group of animal fluids on the whole is directly related to the group of hard parts, the excessive secretions of the blennorrheas clearly reflect the structural conditions in question.

The one extreme of trachoma, watering, which forms the starting point of the pathologic cellular proliferation, is always accompanied by serous secretion (since gelatinous fluids, containing nothing but the least oxidized albumin, are primarily responsible for the nourishment and further creation of simple protoplasm).

The middle stage, the discharge of mucus (in which the tissue is already very prone to form papillae, but is not converted into true granulations until much later), never fails to be accompanied by mucous discharges; the latter are much more highly oxidized than the serous secretion and much less so than the purulent lymph.

Lastly, the fastigium of trachoma (identified by the formation of fully developed papillae) is always accompanied by manifestly purulent discharges, because the firmer papillae (in which delicate vascular nerves and vegetation nerves are already germinating) proceed solely from the fluid having the greatest consistency and the greatest viscosity.

Article 62.

aa) Similarity of the blennorrheal secretion to the socalled pus, based on the identical nature of the processes which produce both secretions.

The sharp distinction made by most authors between blennorrhea and socalled suppuration (98) appears doubtful when we subject all the essential and accidental symptoms of both pathologic conditions to searching analysis. -

In order to explain my assertion in greater detail, I shall at once group together the essential symptoms of those diseases in the order in which they appertain to the individual stages of development in question.

The minimum degree of the reproduction process present in suppurations is manifested during the first period of simple wounds not likely to heal by first intention. From the arrest of hemorrhage on, limpid thin serum (making the dressings very moist, resembling the discharge during watering) escapes from the wounds.

(98) See the book by J. C. Reil, "Ueber die Erkenntniss und Kur der Fieber", volume 2, pages 277-290, 1799.
Halle: Curt. 1799-1805. Octavo size.
See also Gruithuisen, 1. c.

With such profluvia, persisting for some days, the surfaces of the wound always undergo noticeable levelling, which can be produced by more actively developed cellular texture alone. If the full significance of these processes of secretion and formation is grasped, it follows that this condition is identical with the watering stage of the blennorrheas.

During the second stage of secretion of these wounds, where the productivity is much more intense, we find (in the presence of mucous, opaque, semi-transparent, thicker, obviously more highly oxidized discharges which are a mixture of serum and pus) the exposed soft parts not only very much levelled and even, but also abounding in fine minute papillae everywhere. By glancing back at the symptoms of the discharge of mucus, one discovers that neither is there any difference between them and this reaction of the solution of continuity.

Lastly, where the plastic force in wounds reaches an even higher degree, the wounds discharge the most highly oxidized albumin, owing to which the excreted incremental substance appears as socalled normal, somewhat thick, pale yellow pus. Simultaneously with this secretion (or at least soon after it has been elaborated) the injured surface sends out larger, perfectly round papillae of flesh. All the chemical experiments that I performed on the latter fluid showed that it does not differ in the least from the purulent discharge of blennorrhea as regards its content of water, coagulable lymph, albumin, pure sodium, and sodium combined with hydrochloric acid.

After repeated anatomic and microscopic tests of those granulations which I had excised from wounds, they too seemed to be analogous in every respect to the papillae which had grown up as the result of true pyorrhea. Accordingly, if we consider the latter period of suppurating wounds side by side with the stage of discharge of pus in blennorrhea, no doubt remains that the two anomalies have an identical fastigium.

Now, since all stages of suppuration do not differ essentially from those of blennorrhea, those processes are likewise to be regarded as having identical fundamental principles, in general. The only reason why they were considered to be two different things is that no general comparison of their symptoms was ever made, and neither were they compared as to the variant forms in which they appear at like stages of development. -

The accidental modifications of suppuration and of blennorrhea likewise resemble each other in practically every single respect. That statement applies particularly to the variant forms which are assumed by both anomalies owing to the operation of remote causes, to the association of foreign bodies, to intercurrent diseases, and to extraordinary virulence. Thus we find the secretion from suppurating wounds, like the secretion from the blennorrheas, tinged with undecomposed blood (sometimes in individual particles, sometimes uniformly distributed); reddish serum or bloody pus then streams forth. Yet such anomalies are purely intercurrent, as a rule, and for the most part they occur merely when diseased structures are still far from being covered with a layer of epidermis, when their return to normal is still remote.

Suppurating parts, like parts affected with blennorrhea, sometimes discharge enormous quantities of pus in which small fragments of cellular tissue mingle closely; this takes place particularly where the protoplasm produced dies again in places, owing to insufficient viability. Throughout purulent and blennorrheal secretions is found, inter alia (owing to precipitation of fibrin in flakes), a mottled appearance not unlike curdled milk. Both profluvia (sometimes from predominant alkalescence, sometimes from preponderant acidity) prove to be so corrosive here and there that they cause corrosions in the corium which they touch. Both these types of anomalies of vegetation are more or less diverted from their regular course as the result of intercurrent pure inflammation, and in this way they undergo the most varied changes.

In the end, the fluids escaping from an ulcer (if it is genuine or the result of a traumatism) and the fluids escaping from parts affected with blennorrhea can also (especially when rendered potent) become actually contagious, by assuming the role of an over-developed pathologic active principle (99).

Now that I have established the identical nature of suppurative and blennorrheal processes by means of the comparisons put forward, it still remains to point out that they likewise explain many other points otherwise obscure. By adhering to that viewpoint we know what we are really to believe about the much discussed purulent blennorrheas, and about the disputed serous and mucous ulcerations. Now it is just as easy to determine in what way large amounts of pus, even without previous pure inflammations, can sometimes flow outward through the surfaces of the organ, and sometimes collect internally. If, here, we also take into consideration how the fibrinous fluid is always the first to appear, and how the development of the papillae originating in this fluid always represents the second stage of secretion (100), it will not be surprising that considerable purulent secretions are sometimes found in the depths of the organism even without the formation of true granulations (therefore before the latter can form).

Article 63.

bb) Contagiousness of blennorrheal secretions in general.

The secretions produced by the increased plastic force accompanying trachoma may not be regarded as merely passive products. They are the consequence of superabundant activity, aberrations of the internal life, and they possess some of the force by means of which they are created. Since, now, these secretions actually possess some of the virulent quality, they become capable of inoculating a predisposed organ with the same anomalous force which created them. Further, since those secretions acquire the property of reproducing the disease which created them in healthy tissues, those very secretions rank as genuine agents of contagion (101). Yet the secretions mentioned by no means possess the same degree of contagiousness in all circumstances; certain factors, both internal and external, can make their contagiousness vary widely.

(99) See Article 63.
See Macgregor, 1. c., pages 30-44.
(100) See Articles 61-62.
(101) See the collection of data on this subject laboriously assembled by Vasani (1. c., pages 47-50) and by Omodei (1. c., pages 67-83).

See the recent accounts of Royston, Edmonstone, and Brigges (quoted by Omodei, 1. c., page 32), who were the first English writers to report the contagiousness of trachoma.

See also the reports of Mongiardini and Rima (quoted by Omodei, 1. c., pages 35 and 101), according to which both were the first Italian writers to establish the contagious nature of trachoma.

In addition, both Vetch (German translation, pages 6-11) and Macgregor (1. c., pages 30-44) have from their own experience recorded very important facts which are eloquent arguments for contagion.

Compare with these also the report of Günther (1. c.), the letter of Sir William Adams (Journal der Chirurgie und Augenheilkunde, volume 1, pages 170-176, number 1, 1820), and my own observations based on the campaign of 1813-1815 and reported in Articles 64-73.

As regards the internal factors, the contagiousness seems to depend chiefly on how excessive the abnormal vital force has become. In other words, when the course of the process is more acute and the virulent quality is abundantly possessed by the matter excreted, the power of contagion increases. When, on the contrary, the disease is mild and those secretions have a dearth of the pathologic active principle, they are obviously less contagious, of course.

As regards the external factors (which, like the internal ones, make the blennorrheal effluvia differ in their power of contagion), they generally endow the secretions with different degrees of this contagion in strict accordance with the same laws which govern miasmas as a whole; these laws are sufficiently well known.

The immediately following acticles explain both factors in greater detail, and particularly: the mode of distribution of the contagiousness among the secretions of the different stages of blennorrhea; and those various aspects of external influences by which contagion is modified most of all.

Article 64.
α) Degree of contagion during watering.

During watering (the lowest stage of development of trachoma) the pathologic active principle practically never develops enough to impart excessive virulence to the secretion. According to my personal experience and the field reports sent me by army medical officers, it appears that the disease is almost never contagious while the profluvia remain merely serous. Only in the following extraordinary conditions did I occasionally see the disease communicated to others even by watering: in circumstances which make the very weakest miasmas unusually strong (102), and also are of the greatest significance in predisposing persons to suffer these untoward effects (103). With reference to the form in which such propagations originate, moreover, I have not yet succeeded in obtaining any more definite information, owing to the rarity of the case. The fact that it is quite exceptional for mere watering (as the most frequent stage of development of trachoma which does not always reach more advanced stages) to give rise to infections is to be considered as the best reason for excusing these physicians who, on the whole, failed to see the contagiousness of trachoma (104).

Article 65.
β) Degree of contagion during the discharge of mucus.

Just as the discharge of mucus represents a stage of transition (because it sometimes tends to be regressive and sometimes tends to be progressive) and in every respect has the attributes of both watering and the discharge of pus, the contagiousness of its secretion has the same attributes.

According to meticulous observations based on several hundred patients, the fluid discharged when the discharge of mucus was regressive enough to reach the stage of watering proved to be, like the serum of watering, positively and absolutely not contagious, as a rule.

(102) See Article 71.
(103) See Articles 135-145.
(104) See Larrey, 1. c., volume 1, pages 203-229.
See chamseru, 1. c.
See Assalini, 1. c., page 105.
See Baltz, 1. c., page 40 et seq.
See Helling, 1. c., page 24 et seq.

On the contrary, there are just as many cases offering incontrovertible evidence that, where the discharge of mucus reaches more advanced stages and closely resembles the discharge of pus, the mucous secretions are, like the secretion of the highest stage of development, infectious.

In view of that fact, I refer the reader to the previous discussion of this aspect of watering in part, and to the following account of the contagiousness of purulent secretions in part, for the contagiousness of mucous effluvia.

Article 66.

γ) Degree of contagion during the discharge of pus.

It is true that the maximum contagiousness commonly falls to the lot of the purulent discharge as the product of the maximum development of trachoma, accompanied by the formation of true granulations. However, contagion itself ensues (during this secretion which for the most part is permeated with the virus) neither in the same way at all times, nor - as many believe - spontaneously. In conformity with certain circumstances to be noted later, the secretions during the discharge of pus are sometimes less adapted, sometimes more adapted, and sometimes not at all adapted to communicate trachoma to healthy persons (105).

In the first instance we see trachoma only after communication of visible bits of pus, consequently when it has developed by contact alone. In the second instance contagion arises even at a distance (just as by means of other very virulent miasmas) by means of delicate, volatile effluvia which our senses can no longer perceive. In the third instance the purulent discharge is so lacking in virulence that it does not have any perceptible pathologic effects - by contact or at a distance - even on individuals with a marked predisposition.

I shall discuss the arguments in favor of this, together with the causes of such modifications, in the order in which they prove that contagion during the discharge of pus may be constant or inconstant in nature, or may be altogether lacking.

Article 67.

αα) Proof that the secretion during the discharge of pus causes contagion by contact.

In consequence of all my experiments (repeated many times), fresh pus obtained from eye patients with fever and brushed under the eyelids of both dogs and cats almost consistently produced watering within twenty-four hours, and genuine discharge of pus at the end of two to three days. The same result was obtained (though on the whole more rarely and almost always somewhat later) where this inoculation material was collected from patients who really were seriously ill, but who did not have a distinct fever.

Rima's investigations (106) taught us that when the secretion during the discharge of pus was brushed over the conjunctiva of the dog it produced trachoma, and that when it was injected into the urethra of the dog it produced gonorrhea.

Vasani (107) notes that, when the eyes of dogs are painted with fresh pus, within four days it causes a disease which, judging by all its symptoms, has the same course as trachoma. The same author observed similar occurrences in a dog dipped in the water which eye patients had used for washing; he observed just as serious effects even when dry pus was placed in the canthus of several animals (108).

(105) See Article 70.
(106) See Rima, quoted by Omodei, 1. c., page 101.
(107) See Vasani, 1. c., page 40.
(108) See Vasani, 1. c., pages 40, 45.

According to a report handed in to the Medical Staff of the Army, Wiebe (the medical officer of the battalion at Arnswalde) painted the eyes of a dog and of a cat with blennorrheal secretion taken from soldiers who had diseased eyes. In both animals watering developed on the third day after the painting, and on the fourth and fifth days appeared a copious discharge of mucus accompanied by loss of cohesion of the palpebral conjunctiva. This discharge increased up to the fourteenth day, but from that time on, thanks to the rubbing in of white-precipitate ointment, it diminished again so much that the disease disappeared altogether several weeks later.

Very often I saw male nurses (who attended to the prescribed cleansing of many patients with running eyes, and in doing so accidentally rubbed their own eyes with uncleaned fingers) affected with frightful trachoma in two to four days. The spread of the evil in the individual hospitals was always much more rapid while I failed to prevent altogether the common use of washing utensils, towels, head-coverings, beds, et cetera.

Macgregor (109) relates that several female nurses, in syringing the eyes of sick children, had the pus spurt into their own eyes, felt sharp pains within five to ten hours, and soon afterward contracted trachoma.

Brigges (110) blames the common use of articles of clothing contaminated with pus chiefly for the spread of trachoma to the warship Ajax, stationed at Abukir [Egypt] in 1801.

Vetch (111) believes so firmly in contagion by contact that he regards propagation of the evil as possible mainly through direct contact with pus alone. In support of his contention he cites this fact: "No military or medical officer has yet contracted the disease, without being sensible of some local communication".

Article 68.

ββ) Proof that the secretion during the discharge of pus causes contagion at a distance.

In order to afford a survey of the pertinent facts here, I shall cite first my own observations in this field, next the observations along this line recently published by Italian and British authors, and then the legacy of the physicians of antiquity regarding the point at issue.

At a very early date, my clue to the method of propagation to be discussed was the circumstance that some patients with minor casualties who shared quarters with patients in the stage of discharge of pus contracted trachoma, in spite of every precaution taken against contagion by contact. Later on, when trachoma repeatedly broke out very rapidly (often two days after the admission of patients in the stage of discharge of pus) in large sections of the military hospitals, although the strictest preventive measures against spreading of the pus had been taken immediately, contagion at a distance became even more probable. Two things made me absolutely certain that in trachoma volatile contagious matter is given off by pus, by its visible and material substratum, and infects other suitable carriers: when several soldiers with perfectly healthy eyes, on being transferred

(109) See Macgregor, 1. c., pages 45-64 (especially 51-54).
(110) See Brigges, quoted by Omodei, 1. c., page 33.
(111) See page 123 of the English text of Vetch, and page 77 of the German translation of Vetch's book prepared by Michaelis.

to rooms previously occupied by trachoma patients, suddenly suffered severe ocular blennorrhea; and when, furthermore, the disease became general two to seven days after the arrival of those individuals in whom not the slightest disease of the eye could be discovered, but who had previously spent a fairly long time in military hospitals for eye patients.

As regards the evidence collected by British and Italian physicians, the following remarks deserve special attention. Edmonstone (112) "conceives the disease capable of being communicated by looking at eyes already affected with it, and gives some cases where the patients ascribed the origin of the disease to that source". In Edmonstone's own case "the disease appeared only a few hours after his exposure to it" (113).

Vetch (114) states (contradicting his earlier views, to some extent) that in England "those regiments received the Ophthalmia from being garrisoned along with others who had suffered from it in Egypt". Vetch (115) likewise declares: "Among the officers, two only were affected, during the whole course of the disease; the servants of both were previously taken ill".

Patrick Macgregor (116) gives a detailed account of opthalmia in the Royal Military Asylum: "All the boys from five to six and a half years of age are formed into one company. It was observed that in the course of the last, and present month, almost the whole of this company took the ophthalmia. Its progress could in their dormitories be traced from one bed to another, in the order in which they were placed, until nearly the whole were affected". He reports further (117) that "The disease did not appear in the Indian army after their arrival in Egypt, although exposed to all the probable exciting causes, until they arrived at Ghiza, where there was an English hospital established for the disease".

Sir William Adams (118) repeatedly became convinced, in the large hospitals of London, that trachoma has a marked tendency to spread by contagion at a distance.

(112) See Edmonstone, quoted in the footnote on page 27 of the English text of Vetch, and pages 17-18 of the German translation of Vetch's book prepared by Michaelis.

(113) See Edmonstone, quoted in the footnote on page 28 of the English text of Vetch, and page 4 of the German translation of Vetch's book prepared by Michaelis.

(114) See page 6 of the English text of Vetch, and page 6 of the German translation of Vetch's book prepared by Michaelis.

(115) See page 9 of the English text of Vetch, and page 6 of the German translation of Vetch's book prepared by Michaelis.

(116) See Macgregor, 1. c., pages 30-44 (especially 35).

(117) See Macgregor, quoted in the footnote on page 10 of the English text of Vetch, and page 7 of the German translation of Vetch's book prepared by Michaelis.

(118) See the letter of Sir William Adams in the Journal der Chirurgie und Augenheilkunde, volume 1, pages 170-176, number 1, 1820.

Vasani (119) proves that the Egyptian ophthalmia did not actually break out in Italy until the Sixth French Regiment, returning from Syria, had landed upon the island of Elba.

Omodei (120) reports observations which unquestionably prove that the virus of infection can be transmitted via baggage, articles of clothing, and so forth.

Scarpa (121) considers trachoma so highly infectious that, in his opinion, the spread of the disease can be combated only by those precautions which must be taken against the plague. -

The older medical writers are not inferior to the modern ones quoted in establishing the contagiousness of trachoma at a distance. Galen (122) thinks that trachoma is fully as contagious as malignant fever. Rhazes (123) contends that a person can easily become infected by looking at patients with running eyes for a long time; Hieronymus Mercurialis (124) is entirely of the same opinion; and Sennert plainly confirms the opinion expressed. Baricellus (125) explains the contagiousness of ophthalmia by noxious effluvia (coming from affected eyes) which fill the air. Forestus (126) asserts that, according to his observations, the spread of trachoma among the general masses (which is sometimes unusually rapid) can be attributed to no other cause save an extremely volatile contagion which belongs exclusively to and is inherent in that disease.

Article 69.

γγ) Proof that the secretion during the discharge of pus is sometimes utterly devoid of contagiousness.

During inspections of military hospitals, in a few institutions I often found that there was no restriction on the common use of washing utensils, that patients with pyorrhea mingled freely with the others (actually lying in the same bed with wounded soldiers), and yet the most searching examination failed to disclose any perceptible propagation of trachoma. These results, in direct contrast to those previously cited, were proof positive that the purulent secretion by no means has the power to communicate trachoma at all times. Conspicuous proof of the truth of this conjecture was likewise afforded by the following fact. No matter how much of the secretion taken from the patients mentioned was brushed into the eyes of animals, it never resulted in trachoma; occasionally it led to the merest conjunctival redness lasting but a short time; and for the most part it had absolutely no visible effects.

Doctor Müller (the Prussian regimental surgeon) inserted blennorrheal secretion under the eyelids of five cats, ten dogs, two rabbits, two little squirrels, two blackbirds, one starling, one yellow-hammer, and one chicken. In not a single instance were the slightest untoward effects observed (127).

(119) See Vasani, 1. c., page 33.
(120) See Omodei, 1. c., page 97.
(121) See Scarpa, in Nuovi Commentari di medicina, Padua, volume 1, semest. I, pages 204-211, number 5, March 1, 1818. (especially 205).
(122) See Galen, 1. c., volume 3, page 116, line 3. See also the history of trachoma, Articles 106-107.
(123) See the aphorisms of Rhazes, 1. c., page 144, particula 24.
(124) See Mercurialis, 1. c., chapter 11.
(125) See Baricellus, 1. c., page 203.
(126) See Forestus, 1. c., Lib. XI, Observ. IV, page 32 et seq.
(127) See Muller, 1. c., page 102.

The facts enumerated (which sufficiently attest the viewpoint under discussion) are also borne out by the case related by Günther (128). In it Adams, in order to show that trachoma is not contagious, deliberately rubbed his eyes with the finger which he had just finished running over the inside of the eyelids of an individual suffering from pyorrhea; Adams did so with perfect impunity.

Article 70.

δδ) Properties of the purulent secretion which determine its inconstant contagiousness, constant contagiousness, or total lack of contagiousness.

Wide experience convinced me that the purulent secretion varies greatly in its contagiousness (129). I was therefore very anxious to learn to recognize the conditions which give rise to this peculiarity. Meticulous observation of large groups of patients led to the following conclusions regarding this point.

First: Usually true volatile contagion, contagion manifestly operating at a distance, results solely from those purulent secretions which, by means of asthenic inflammatory fever, cause sympathetic reaction of the whole body. The following arguments are the main ones in support of this. Examination of many patients of this type at close range makes one, almost without exception, experience some burning and marked itching in the eyes. The more that I attended to patients of this type with fever one right after the other, the more distinctly and the more severely did I likewise experience the peculiar sensation described. Doctor Wiebel (Staff Surgeon General) and Doctor Oelenschlager (Chief Staff Surgeon) assured me that they had had the same experience. The talented artist of Cologne, Mr. Grein, complained so bitterly of those sensations while he was sketching trachoma patients suffering from fever that he completed the work begun only with reluctance. It was perfectly obvious that the contagion was being diffused from the rooms containing trachoma patients in a state of fever. Where a single soldier who had been sent to the infirmary was the sole source of the general infection, either he himself was suffering from this form of the disease, or at least he had previously been in the company of patients with fever. Patients who over a long period had caused no harm to their room-mates suddenly became the cause of rapid propagation of trachoma by suffering severe asthenic inflammatory fever, as their trachoma grew worse.

Secondly: Purulent secretions unaccompanied by fever produce no miasma operating at a distance, but when their progress is not hindered they do produce a miasma which propagates the anomaly by contact. The itching and burning which are always the penalty of remaining beside patients with running eyes and fever were never experienced by me, or by any of my colleagues, in calls on apyretic eye patients, no matter how long we stayed. Mr. Grein, in working on those drawings for which apyretic patients with pyorrhea were selected, sat very close to the diseased eyes without experiencing any disagreeable feelings. Not once did I see general contagion result from apyretic eye patients after the necessary steps for the prevention of propagation by contact had been taken. Although the fluid discharged from the eyes of these individuals seemed perfectly harmless as regards exhalation, on the other hand, during the progressive development of the process it by no means lacked the power to produce trachoma by contact in perfectly healthy persons. This apyretic anomaly was always very distinctly propagated where everything necessary to prevent spreading of the pus was not done properly; and, almost without exception, more or less severe blennorrhea resulted when the eyes of animals were painted with fresh secretion derived from such patients with pyorrhea.

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(128) See Adams, quoted by Günther, l. c., pages 39-67 (especially 46).
(129) See Articles 63-69.

Thirdly: Pyorrheas which are on the wane or purely regressive, whose secretion no longer contains an excess of the virus (130), are utterly devoid of contagiousness. When, in the circumstances just mentioned, I collected pus and dropped it into the eyes of animals, there was sometimes a little reddening of the conjunctiva, to be sure, but never genuine blennorrhea. Secretions derived from patients with sarcomatous ectropion (131), when used for such tests, did not once cause redness. In all cases where no harm resulted when patients with running eyes lived in close contact with other individuals (where, despite ample opportunity for contact, despite the common use of beds, washing utensils, and so forth, there was not the slightest spreading of the disease), the eye patients presented only the degree of blennorrhea under discussion (the one fast approaching the lower stage of development), blennorrhea subsisting for the most part merely from sequelae. In the case of the individual by which Adams (132) sought to prove the lack of contagiousness (by rubbing his own eyes with freshly removed pus), the fastigium of trachoma was long since over. At least this follows from the fact that in that case the granulations upon the inside of the eyelid proved to be not large, spherical, and very spongy, but tiny and firm.

Article 71.

ε) Changes which external factors produce in the contagion of trachoma.

The great influence of the atmosphere (owing to its widely varying temperature as well as to its different admixtures of damp vapors and animal matter) on the contagiousness of trachoma appears plainly from the various data on this point collected by myself and by other physicians.

The following data are of special significance in proving that the virus of trachoma thrives in air which is damp and warm, while its activity is impeded by a dry and cold state of the atmosphere. During the years 1813, 1814, and 1815 (when the barometer and thermometer recorded fluctuations out of the ordinary), rainy summers alternated with mild and damp winters. While this atmospheric condition prevailed, the Egyptian ophthalmia (owing to steadily increasing contagiousness) was so rampant that it finally swept over Germany into the Netherlands, and up to the banks of the Seine (133). At the beginning of the year 1816, when weather much more in keeping with the different seasons set in, contagion diminished appreciably. During the years 1816 and 1817 the hard winters were followed by fairer and clearer summer weather, and everywhere the epidemic of the disease practically died out (134).

Cities whose atmosphere had a marked tendency to be saturated with moisture (owing to the presence of large streams, lakes, and so forth in the vicinity) were the first to suffer epidemics of the Egyptian ophthalmia. Not only were the signs

(130) See Article 63.
(131) See Article 27.
(132) See Adams, quoted by Günther, 1. c., pages 39-67 (especially 45-46).
Compare further Articles 19, 23, 27, 69.
(133) See Articles 122-132.
(134) See Articles 122-132.

of this epidemic very plainly visible in Cammin, Wollin, Stettin, Zehden, Torgau, Dresden, Wesel, Dusseldorf, Cologne, Coblenz, Mainz, Maestricht, Liege, and Namur. Trachoma also prevailed inside the convalescent homes of those places (as I observed myself, and according to the official reports sent me), and was far more stubborn than in other localities where the hospitals were situated far from bodies of water (135). -

The contagion introduced into the foggy and damp country of England from Egypt rapidly became highly malignant. Until quite recently its force remained undiminished there (136). The clearer skies of France, on the contrary, dispelled the Egyptian ophthalmia so quickly that the latter died out almost completely soon after the army had landed (137). Trachoma spread almost steadily within the fruitful but damp delta (continually abounding in humidity), while in the dry regions far removed from the banks of the Nile (particularly in the valley of Baalbek, Diarbekr, and in the plains of Hauran) there was absolutely no trachoma (138).

As regards the modifications which the virus of infection (owing to the different amounts of animal ingredients in the atmosphere) undergoes, many circumstances go to show that the power of contagion of trachoma is almost always increased by more intensive animal vapors, and that on the contrary the potential contagiousness of trachoma is almost always decreased by air which is pure and fresh. Although the fact that there is more nitrogen than oxygen in any atmosphere in which many humans have been confined for a fairly long time cannot be proven with the eudiometer, according to the latest tests, one thing remains certain. Atmosphere which is particularly changed owing to the close confinement of large groups of human beings (air which is more highly "animalized", as it were) is very favorable to contagion in general, and to the contagion of trachoma in particular. I repeatedly noted that a few individuals who had healthy eyes, but who had been exposed to pyorrhea at some earlier date, remained in the company of other patients without causing harm so long as there was no crowding, but that they were soon the source of infection when too many were quartered in the same room with them.

When the number of patients was very small, the discharge during watering was never contagious. The reverse sometimes happened where, after many people had been crowded together, the discharge during watering was rendered unusually virulent (though so lacking in contagion at other times) by air saturated with animal vapors. As the rooms of patients were too religiously kept shut (for fear of the ill effects which catching cold usually has on trachoma patients), the spread of the disease noticeably got beyond bounds. Later on, after I had had the rooms well aired during the nice part of the day, after I had kept all the patients far apart from one another (since I was becoming more and more convinced of the harmful influence of "animalized" air), the spread of trachoma by contagion diminished appreciably. The Egyptian ophthalmia reached its maximum malignancy among the

(135) See Articles 122-123.

(136) See Articles 115-116.

(137) See Articles 112-114.

(138) See the German translation of the French text of Volney, 1. c., volume 1, page 187.
See the German translation of the English text of Vetch, 1. c., page 16.
See Assalini, 1. c., pages 97 and 110.
See Chamseru, 1. c.

fourth Infantry Regiment of East Prussia while that regiment was garrisoned at Dresden. A similar fate overtook Emperor Alexander's Prussian Granadier Regiment, in similar circumstances, at Berlin (139); as soon as the latter troops were billeted in private homes, the disease declined to an extraordinary degree.

Edmonstone, Farrel, and Macgregor saw the exacerbation and rapid spread of the Egyptian ophthalmia among the English troops wherever the soldiers were grouped together more closely (140).

Vetch (141) relates that the second battalion of the 52nd English regiment (light infantry) almost always remained free of trachoma while marching to Hythe, Maidstone, the Riding Street Barracks, and Dover, but that the disease always broke out anew among the troops immediately after they had taken possession of the barracks.

According to the report of Omodei (142), the Sixth Italian Regiment contracted the Egyptian ophthalmia in the year 1803 while upon the island of Elba; later on that regiment had served in all the campaigns of Spain with impurity, and did not become a prey to the fastigium of trachoma until, in the year 1812, it took possession of the barracks of Ancona.

How the contagion gains in virulence in different zones in the same way, other things being equal, is evident from a glance at the facts just mentioned, as well as the following ones. Soon after the admission of several mariners, there was a rapid spread of the Egyptian ophthalmia in the Marine Hospital of Stockholm. Also, there was an epidemic spread of trachoma produced by a small number of infected sailors in the coast fleet stationed before the laen of Bohus [Sweden] (143).

Article 72.

ζ) Course of contagion in the epidemic spread of trachoma.

The more carefully that we trace the history of the Egyptian ophthalmia, the more manifest it becomes that every epidemic of this disease (as regards both the degrees of contagion and all other aspects) depends not only on external forces but also on certain internal conditions of the persons affected (144). This was best seen during the later campaigns in the independent increase and decrease of this epidemic, which came here from the outside, which underwent some modifications to be sure, but was by no means intermittent (145).

At the beginning of the year 1813, when the temperature steadily underwent sharp changes and the weather was very wet, the first traces of trachoma could be detected in those very places where the Prussian army had been in closest contact with the French army (146). From this time up to the last months of the same year, the course of this epidemic was as follows. On the whole, the usual form of the disease was merely watering. Since the disease was benign, during this period but few soldiers had to be put in military hospitals. The contagiousness was so slight that only extremely predisposed persons fell ill, that therefore the disease was rife only in small sections of the army (chiefly in a few com-

(139) See Article 73.
(140) See Omodei, 1. c., pages 104-105.
(141) See the German translation of the English text of Vetch, 1. c., pages 3-5.
(142) See Omodei, 1. c., pages 104-105.
(143) See Frölich and Hellström, 1. c., page 132, for the report on the Marine Hospital.
See Rudolphi, 1. c., page 135, for the report on the coast fleet.
(144) See Articles 106-132.
(145) See Articles 122-126.
(146) See Article 124.

panies whose members had acquired a very marked predisposition through the same source, clothing, species of arms, and mode of life). During this initial stage of the epidemic disease, it also appeared to result for the most part from external influences. At least this would be indicated by the circumstance that the watering rapidly progressed to the stage of discharge of mucus almost universally right after the meeting of all the vast numbers assembled for the battle of Leipzig (147).

As this anomaly had already recurred more often in predisposed persons, it showed a marked increase in every respect during the year 1814. Although at this time, as previously, trachoma began in the form of watering, it now ended in complete blepharo-pyorrhea, for the most part. Thus the contagiousness immediately became so great that whole regiments were affected, and that the medical establishments (even after peace had been declared, indeed even after the entire army had returned home) were increasingly filled solely through the spontaneous advance of the epidemic, once it had started to increase. Moreover, although during this second period intercourse between the army and the private citizens had been promoted by widespread establishment of hospitals, by numerous transfers of patients, and by constant billetings, there was no spreading of the disease to the rural population anywhere (148). Therefore in the latter respect, too, epidemic contagious ophthalmia obeyed the law of all other epidemic and contagious diseases, namely, the law that such epidemics - usually prior to their peak - do not attack persons who show a marked absence of predisposition.

After the communication of the more intensive contagion to predisposed individuals had recurred with unwonted frequency, the epidemic reached its highest point in the spring of 1815. This was brought about - and also brought about much more quickly - by the fact that several German regiments already infected with blennorrhea had joined forces with the English army, a few detachments of which latter had previously fought by the Nile. During this third period, before the blennorrhea came to an end, it went through all its stages right up to absolutely complete ophthalmo-pyorrhea, in almost every patient. From this time on the virus of contagion became so potent that it overcame even persons having a marked absence of predisposition; therefore at about this time, in accordance with the law already mentioned, more severe trachoma was for the first time seen to spread even to the general masses in several places (149).

Toward the end of the year 1815 the epidemic gradually began to die out. Its disappearance became certain from the ensuing communication of the disease to the general masses during the fastigium, hence also from the fact that the contagion - distributed among countless persons having no predisposition - produced hybrid forms lacking in infectiousness in direct proportion as they bore less resemblance to the original form of the anomaly. Shortly afterward the course of the disease, which took the form of a recurrence in most persons, was confined to its middle and lowest stages of development. At the beginning of 1816 the spread of this disease finally ceased almost wholly (150).

It is also noteworthy that that decline of the epidemic in the year 1816 by no means excluded its recurrence. Trachoma continued sporadically even after that time, in some parts of the country (151). Consequently the disease was always able

(147) See Article 124.
(148) See Article 125.
(149) See Articles 115, 116, 126.
(150) See Article 126.
(151) See Article 126.

to recur - thanks to every favorable combination of circumstances -, as actually happened even later in many places, and to become widespread. How readily this happens, how rapidly this epidemic - owing to definite influences, after every complete cycle - breaks out afresh is evident from the behavior of trachoma in England. There, owing to the dampness of the air, its cycles are repeated so very often that, just as in Egypt, it seems to prevail almost continually, because of the alternate increase and decrease without a pause (152).

Article 73.

) Relation of the contagion of trachoma to the contagion of epidemics of typhus fever.

Contagious typhus and the Egyptian ophthalmia are to be regarded as the general diseases most prevalent in the army from 1813 to 1815. Their mutual relationship led many physicians to believe that both diseases proceeded from the same cause and were alike in nature but different in degree. Serious consideration of the facts on which the theory was based, however, proves the opposite to be true.

First of all, an attempt was made to prove that the contagion of trachoma and the contagion of typhus are identical in every respect, because both anomalies appeared chiefly in those very regions traversed by the retreating French troops. Yet from this fact it follows merely that the French army was probably the source of both diseases, but by no means that one and the same cause was responsible for them. There is ample proof of the spread of the typhus virus in the manner mentioned; such proof is a matter of common knowledge. An affirmative reply must be made to the question as to whether those soldiers brought back with them, even in part, the miasma of trachoma from Egypt. This is because, according to observations in support of it, once the disease is contracted, it lies dormant for a long time in many individuals and can become active again only after years, as the result of propitious circumstances, particularly as the result of overcrowding of large groups of people (153). But if - as the above arguments permit - we assume the latent existence of the trachoma virus and of the typhus virus among many sections of the French army, it explains the subsequent spreading of both diseases far more naturally than does the supposed identity of these viruses.

Furthermore, some physicians therefore believed in the above source of the contagion of trachoma because many soldiers in barracks previously occupied by typhus patients suddenly contracted trachoma. Only a few garrisons where this happened (particularly those in Dresden and Berlin in which Prussian soldiers contracted trachoma) were so thoroughly cleansed, aired out, and whitewashed before receiving healthy troops that hardly any active typhus miasma could survive (154). Should those cases leave any doubt, it is resolved by the following: by the realization that trachoma was not always contracted by the troops who occupied those

(152) See Assalini, 1. c., page 97.
See Ware, 1. c., pages 9-19.
See the letter of Sir William Adams in the Journal der Chirurgie und Augenheilkunde, volume 1, pages 170-176, number 1, 1820.
See Also Articles 115-116.

(153) See Articles 71, 112-114.
See the letter of Sir William Adams in the Journal der Chirurgie und Augenheilkunde, volume 1, pages 170-176, number 1, 1820. See particularly pages 172 et seq.

(154) See Article 71.

quarters right after the "housecleaning", but was sometimes contracted by the troops quartered there later. That statement applies particularly to the fate of Emperor Alexander's Prussian Grenadier Regiment in the garrison assigned to it at Berlin. During the spring of 1813 I converted that particuiar garrison into a large military hospital for several thousand typhus patients. Later on, after undergoing a routine cleaning, the garrison was occupied by a battalion of the Elbe Infantry Regiment, which was soon succeeded by the Kurmark [Brandenburg] Landwehr Artillery. Neither of these two divisions of troops suffered trachoma at all. But trachoma very soon broke out among Emperor Alexander's Grenadier Regiment after it occupied those quarters in 1816, on returning from active service (155). Furthermore, if the facts related are compared with the many cases (156) where English and Italian detachments became grievously afflicted with trachoma in barracks which had never contained typhus patients, every fair-minded person will be convinced of the following facts. Garrisoning in no way caused trachoma through the medium of the supposed communication of the typhus virus. On the contrary, the cause of that epidemic is much rather to be sought in the increased virulence (itself the result of concentration of numerous troops) of the contagion brought back by the soldiers (157).

Lastly, it was claimed that the identical nature of both these miasmas was clearly established as well by the fact that they succeeded each other. To be sure, trachoma appeared during the beginning of the campaign (when typhus raged) only in its very mild forms, and no one can deny that it did not become virulent until near the end of the war, when nervous fever was a rare and very benign occurrence. But this correlation existing between typhus and trachoma is to be explained in a wholly different way, which does not run counter to individual experience. In other words, if we do not disregard the law (158) which is generally valid where contagion is concerned (according to which law two kinds of commonly contagious diseases as a rule never coexist, according to which, rather, one of them usually drives out the other), we at once have a satisfactory explanation of why the eye disease fell off at the height of the epidemic of fever, and why the fastigium of the eye disease was not reached until the fever began to abate. Moreover, the reason for the appearance of the two epidemics in the very order described and no other is to be sought, most probably, in the following conditions.

At the beginning of the campaign the soldier was in hastily recruited armies, as yet totally unused to the ways of war; his physical strength was more or less unequal to the still unaccustomed strain put on it; many anxieties preyed on his mild and, despite his firm resolutions, he was uncertain as to the outcome; and, although he placed his hopes in the mysterious future, he trembled. Such a physical and mental state at the outset of the war necessarily produced in the majority of individuals an excitability of the whole nervous system which paves the way

(155) For the detailed written account of these very important observations I owe all the more thanks to Doctor von Koenen, Privy Councillor, because it proved more instructive to me than anything else could have, during my absence from Berlin at that time. See also Article 71.

(156) See Article 71.

(157) See Article 71.

(158) See Brandis, 1. c., Articles 131 and 137.
See J. C. Reil's "Entwurf einer allgemeine Pathologie", part 3, pages 180, 181, and 189.

particularly for general diseases, those which undermine the health (159). Later on almost the opposite extreme prevailed. The strong youthful army - which had grown perfectly familiar with life at the front -, since it had gained the advantage through fortunate occurrences, had fewer privations to combat; crowned with success, it had attained to a truly higher life. But, owing to such a state of body and mind - quite different from the preceding one -, there neceasarily developed that diathesis which successfully counteracted the typhus virus (which latter always produced merely weak tendencies).

If, now, we compare this predisposition which is different at different times with the abovementioned law (according to which two kinds of commonly contagious diseases almost never co-exist), the following becomes clear. At first trachoma suffered a falling-off because the corresponding tendency toward typhus was universal then. Later, on the contrary, the germs of trachoma developed to so wide an extent because there was no longer anything to prevent their free growth after the susceptibility to typhus had disappeared and its march was checked in proportion.

In order to present perfectly adequate supplements to the conjectures regarding the alternate occurrence of the two epidemics which I have expressed, I shall report here some additional information on this point obtained at the siege of Torgau. The troops defending this fortress were confined in much too small a space, owing to refugees and to the transfer of many patients from Dresden even before the siege had started. They had to endure the worst hardships while poorly fed. They had no rest by day or night, owing to one lively attack after another. They saw themselves compelled to abandon the most important outworks, which gave the besiegers a great advantage over them. They heard reports that their fellow-soldiers at a distance were having increasingly bad luck, and their hopes of ever being relieved dwindled with every piece of news. In these circumstances, when all these depressing influences increased the susceptibility to the typhus virus, which had already developed in the overfilled military hospitals, the epidemic of fever became more and more widespread. In direct proportion as the contagion in this way recurred more often among individuals with a predisposition, the disease more and more conspicuously acquired that frightful degree of malignancy which, within four months, took the lives of thirty thousand men in the garrison troops and the Governor, Count Narbonne-Lara (160).

At a very early date I became convinced that the miasma of trachoma lay very dormant inside the fortress during that fastigium of typhus, and that not even the slightest trace of its effects was observed in the garrison troops during that period. My conviction was based on the remarks of Desgenettes when, at the orders of the commanding general, Count Tauentzien von Wittenberg, I was sent with a flag of truce into the still besieged city; I was sent to make a plea for surrender on medical grounds. I was convinced of it later on, after the post had been evacuated, by the medical inspection (161) of the prisoners not on the sick list of the garrison troops (numbering 4875 men), as well as by the examination of the French military hospital (into which 2565 patients had been crowded) given into my charge (162).

(159) See C. F. Graefe's "Die Kunst, sich vor Ansteckung bei Epidemien zu sichern", pages 25 et seq.

(160) See G. A. Richter, 1. c., pages 19-20.

(161) See G. A. Richter, 1. c., page 218.

(162) See G. A. Richter, 1. c., page 25.
See "Das neue Deutschland", 1. c., volume 1, pages 726-728 and 734, number 6, 1813-1814.

The situation of the besieging army was exactly the opposite of the one noted inside the garrison. The besiegers were amply supplied with all the necessities of life, their hopes justly soared ever higher as they received news of the victories won by their fellow-soldiers at a distance, and - with their own victory ever more assured - they suffered no ill effects from overcrowding or even from severe strains. Since the physical resistance of the besiegers was now increased materially, they showed but little tendency to contract typhus. Accordingly, outside the fortress typhus was not only exceptional but also, when contracted in individual cases, always unusually benign. But in direct proportion as the typhus miasma did not develop among the besiegers, the latter suffered an increase in trachoma, which for the first time assumed epidemic proportions in this particular instance (163).

Weighty evidence of how little the alternate rise and fall of those epidemics is to be regarded as the basis for the analogous nature of the two diseases is furnished by the following circumstance, too. A similar relationship obtains between trachoma and many other diseases. On inspecting the numerous military hospitals placed under my supervision at that time, almost as a rule I found no trachoma in all individuals suffering from diarrhea or dysentery. and I repeatedly noted how rapidly trachoma gained headway when those abdominal diseases had come to an end. Doctor Fischer (Physician-in-Chief), whom I had placed in charge of the Prussian hospitals at Liége in 1815, made the observation that trachoma spared all persons who were afflicted with severely suppurating wounds (164). Doctor Wegler (Councillor of State), who had charge of the hospitals at Coblenz, found that all soldiers suffering from inveterate ulcers of the foot were immune to trachoma (165).

For the following reasons, we are forced to consider trachoma purely as a very special disease with a contagion sui generis. The above arguments do not offer a single fact in support of the theory that the typhus virus and the trachoma virus are identical. Neither is there any proof that those miasmas differ in degree alone. Rather, when these two epidemics coincided (as in the case of other epidemics differing from each other essentially), their mutual antagonism was unmistakable. Lastly, epidemic contagious trachoma was distinctive in every respect (166).

Article 74.
g) Etymology.

The commonest term for this disease has been the Egyptian ophthalmia. For the sake of general clarity I have retained this name up to the present, until the nature of the anomaly was fully established. It by no means meets the requirements of unequivocal descriptive nomenclature. The very term ophthalmia is misleading, since it has always been used very arbitrarily to denote a great many kinds of ocular defects. The adjective Egyptian is, on more grounds than one, unsuitable: partly because contagious ocular blennorrhea is not derived from Egypt alone; partly because it is not the only disease present there by any means, but is purely one among many other varieties of eye diseases there, as in most countries (167).

(163) See Articles 122-126.
(164) See Fischer's "Bericht", dated Liége, September 6, 1815.
(165) See Wegler's "Bericht", dated Coblenz, September 30, 1815.
(166) See Article 72.
(167) See Articles 106-111.

Some writers call this disease the eye plague, although it has nothing in common with the nature or with any aspect of the plague. If by this term we wished to allude merely to the possible sad fate that awaits victims of this disease, the same practice would have to be followed in nearly all eye diseases, because almost all threaten the existence of the organ affected when they reach their advanced stages just as much as blennorrhea does.

The terms glandulous ophthalmitis, blepharophthalmia, blepharophthalmitis, and blepharotis glandulosa are likewise to be rejected. Glands can indeed be inflamed, but inflammations cannot be glandulous. Furthermore, the original site of trachoma is by no means in purely glandulous structures, but in the conjunctiva (168). Inflammation is undoubtedly the basis of trachoma, as of all local anomalies of vegetation; but if we called all these conditions inflammations simply on that account, widely divergent diseases would be lumped together indiscriminately. The epithet of inflammation may be applied only to an absolutely pure inflammatory process which is free from extraneous elements. I have already shown, in earlier sections, how little trachoma deserves to be classed as a pure inflammation (169).

The terms ophthalmia bellica, ophthalmia militaris, and ophthalmia catarrhalis also appear unsatisfactory. Trachoma is seen to develop in times of peace as well as during war. It attacks soldiers and becomes widespread among the general masses. Sometimes trachoma and catarrhal fever are concomitant, but often, too, they are not at all so (170). In order to avoid various false suppositions (for which the less appropriate term in use until now is partly responsible) in the future, we must hunt for a name which expresses the character of trachoma as definitely as possible. For that purpose I should like to propose the term of *logado-blennorrhea*. According to the earlier works on anatomy, λογάς (171) can mean conjunctiva, primarily, and can be combined with the technical term *blennorrhea* (likewise borrowed from Greek) without the slightest objection. In this way we gain a double advantage: the distinctive feature of the abnormal process is accurately indicated (172); and the structure which proves to be the seat of the disease is pointed out.

Perhaps many might raise the objection that trachoma is not to be named for the conjunctiva alone, since the disease can involve all the ocular membranes. But I cannot regard this objection as well taken, for the reason that ocular blennorrheas (with all their essential properties) usually begin inside the conjunctival tissue, and accordingly reach that extreme extent by no means necessarily but only accidentally, when unusually severe (173). Moreover, once we have found a fitting name for the species of disease, it is not difficult to label its many varieties properly, too (174). Inasmuch as trachoma (for instance, as regards its spread among large groups of people) sometimes depends on both forces of the universe and the action of a virus of infection peculiar to it, the term may appropriately be amplified into logado-blennorrhoea epidemico-contagiosa (175).

(168) See Article 60.

(169) See Article 59.

(170) See Articles 82-84.

(171) See the words λογάς (*album oculi*, white of the eye) and σφενδόνη (funda, white of the eye) in: the "Oeconomia" of Hippocrates, 1. c., page 604; de Gorris, 1. c., page 271; and C. H. Schreger, 1. c., page 205.

(172) See Article 55.

(173) See Article 60.

(174) See Articles 79-80.

(175) See Articles 92-105.

Chapter II. The forms of trachoma.

Article 75.

As in all anomalies of vegetation, in logado-blennorrhea (176) there is evidence of the combined action of nerves and vessels in the different synochal, erethistic, and torpid forms (which are sufficiently well known). -

Where ocular blennorrheas remain mild and circumscribed, only those groups of nerves and vessels which are an immediate part of the diseased structures participate in the manner described. -

If trachoma gains in extent and intensity, if major nerve trunks and vascular trunks in the vicinity likewise become involved by the disease, there are soon signs of a simultaneous involvement of the whole organism. -

As a rule, this local vascular and nervous reaction has the same characteristics as the general reaction just mentioned; if the palpebral reaction is, for instance, synochal, the concomitant fever is likewise synochal, for the most part. In a few cases, however, the local reaction and the general reaction are at variance. Occasionally, therefore (when all activity is so concentraced in the structure affected that it is conspicuously absent from the whole organism), we find the synochal or the erethistic character much in evidence in the purulent eye, while the inflammatory fever present (as judged by the pulse, temperature, subjective feeling, et cetera) appears completely torpid. -

These forms of blennorrhea by no means occur strictly in sequence. Although, in the majority of individuals, the synchal form is succeeded by the erethistic and the latter by the torpid, although the synochal form is almost always observed at the outset and the torpid form nearer the end of the disease, trachoma is occasionally seen to begin right with torpor. Sometimes completely torpid logado-blennorrheas are seen to turn into erethistic or even into genuine synochal reactions. -

Above all, the forms of trachoma must not be confused with the various stages of its development. Experience teaches us that, in spite of two facts (that watering and the discharge of mucus are usually accompanied by the milder stages of erethism and torpor; and that even the discharge of pus is usually accompanied by the severest degree of synocha, erethism, or torpor), in a few cases any of the forms of vegetation mentioned may also be associated with any of the stages of development of trachoma mentioned. This is all that I am going to say about the characteristics of the Egyptian ophthalmia in general. I shall deal with its special aspects in the following paragraphs.

Article 76.

a) The synochal form of logado-blennorrhea.

The synochal form is the result of a simultaneous increase in irritability and sensitiveness. Even though there is often sufficient reason for synocha to appear in trachoma it does so but seldom, because, for the most part, the excessive secretion uses up too much of the activity of the nervous system and vascular system in these circumstances. Synochal reactions associated with trachoma last for twelve to twenty-four hours as a rule, and only in exceptional cases for two to three days. The earlier that the copious discharges appear, the sooner is this form of vegetation transformed into manifest erethism or torpor. All signs which point to synochal blennorrhea are the result of increased activity of vessels and nerves. When those symptoms are present in moderation they indicate a lesser degree of this involvement, and when they are more pronounced they indicate a higher degree of this involvement. Where the disease is localized they are perceptible only locally, for the most part; but where it is widespread or very intense their presence is indicated by definite anomalies of the general condition of health.

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(176) See the book by J. C. Reil, "Memorabilium clinicorum", 1. c., Fasc. I, page 54.
See the book by C. F. Graefe, "Normen für die Ablösung grösserer Gliedmassen", 1. c., pages 34, 35, 75-80.
See the book by C. F. Graefe, "Rhinoplastik", 1. c., pages 12, 146-149.

aa) Local symptoms of synochal logado-blennorrhea. In spite of its great intensity, the redness of the palpebral conjunctiva and of the tarsal edge proves to be pure and bright. In the advanced stages of trachoma it extends far beyond the rims of the lids until it gradually disappears as it approaches the skin of the face. Photophobia lasts so long that it is practically never absent. In every point of the affected part the pain is gripping, shooting, and burning. Where even the internal membranes begin to suffer, too, the other symptoms already mentioned are immediately augmented by optical illusions of brilliance and fire, which continue even in the dark. In the synochal form we always find a considerable increase in the temperature of the affected structures as well as of the structures in the immediate vicinity. The palpebral swelling present, which is very sensitive when touched, always feels tense and hard. It is either painful or utterly impossible to move the eyelids and eyeball at all. Although the quality of the anomalous secretion is found to correspond to the stage of development at the time, the quantity is found to be small.

bb) General symptoms of the synochal form. The pulse is hard, full, moderately accelerated; the skin is dry and burning; the feeling of heat in the whole body is marked and alternates with chills only at the outset; the thirst cannot be quenched; the urine is crimson and scorching; the feces are hard and scanty; the blood of bloodletting is often covered with a strong and firm crusta pleuritica. For this reason all patients complain of constant discomfort. Many become a prey to delirium sooner or later. It is likewise noteworthy that this form usually attains its peak only in easily excitable and also robust constitutions. Young, full-blooded athletic individuals who (when heavy eaters and hard drinkers) take plenty of exercise in the open air are particularly susceptible to genuine synochal blennorrheas.

Article 77.

b) The erethistic form of logado-blennorrhea.

When this form is present, sensitiveness is increased but irritability is decreased. Erethism most often accompanies trachoma, so long as the course of trachoma is acute. Where the initial form of logado-blennorrhea is not synochal, it is erethistic as a rule. The degrees of the erethistic form are many, sometimes easy to bear, sometimes causing severe shock. The milder degrees usually accompany watering and the discharge of mucus; the severer degrees, on the contrary, are more inclined to accompany the discharge of pus. Moreover, erethism is also different in that it more closely approaches synocha at certain times, and torpor at other times. It is more like synocha so long as the irritability appears not much abated as yet; it is more like torpor when, as the irritability abates considerably, the sensitiveness is also about to abate. In the former instance the symptoms of erethism are combined with several attributes of synocha;

in the latter instance, on the contrary, erethism has a few of the characteristics of torpor.

aa) Local symptoms of erethistic logado-blennorrhea. In general, we find the palpebral conjunctiva and the palpebral rim more or less dirty red in appearance. The outside of the eyelid is livid (usually at the tarsus alone) in the milder stages, and pale violet red (deep red at the rims of the lids, and from there on spreading imperceptibly toward the skin of the face) in the more advanced stages. The affected parts are unusually sensitive when touched. The pain (which here is often even more severe than in the synochal form) affects the eyelids, the eyeball, but most of all the frontal region. From the forehead it sometimes extends well toward the parietal bone. In that way it becomes so very excruciating that, when it is deep-seated, from time to time it darts through the whole region affected with the speed of lightning.

All the above forms with painful sensitiveness suffer exacerbations periodically. At their height they sometimes assume such proportions that many individuals are severely weakened after every single attack, and that others are a prey to an agony of despair. When erethism is present, photophobia makes its appearance even in the milder stages of trachoma and, in these circumstances, readily turns into true photopsia. Not only patients but also all who touch the affected parts plainly experience a more acute feeling of heat in the eyelids and in the eye.

In the more advanced stages, the massive swelling of the outside of the eyelid is at once perceived to be neither hard nor tense but rather puffy. In the early stages movements of the eyelids are in large measure impossible because of spasmodic contraction; in the later stages they are utterly impossible because of concomitant edema. Where, during erethistic logado-blennorrhea, the eyeball changes its position spasmodically, against the patient's will, every single recurrence of such a spasm of the eyeball is always the starting point of the recurrence of general severe pains. In addition, in erethism we see a steady stream of the copious secretion.

bb) General symptoms of the erethistic form. Patients complain most of nausea and of having no appetite, despite the absence of any perceptible organic gastric trouble. As a rule, the skin of the whole body appears dry and burning. Without exception, we find the pulse contracted until small and frequent; also, when it resembles synocha, the pulse is somewhat hard; but where erethism tends toward torpor the pulse is very soft and easy to compress. During this form sleep is impossible for all patients, they toss about all day long and all night long, they jump out of bed, they want to run away, and not seldom they steadily remain in a state of deep delirium. In these circumstances the urine is usually dirty looking, largely decomposed, and occasionally very pale. Whenever potent, erethism acts quickly and out of all proportion, but then it is not of corresponding duration. Here the real cause is often a very sensitive general constitution. Most of the individuals who suffered a higher degree of erethism were young, delicate, and weaklings. This form is most apt to develop when heat and humidity prevail. We also found it primarily in persons who had contracted trachoma by contagion, because such miasmas almost always contain merely germs which produce asthenic diseases, and almost never contain germs which produce asthenic diseases.

Article 78.
c) The torpid form of logado-blennorrhea.

In torpor both irritability and sensitiveness are reduced. Torpor is a very frequent concomitant of trachoma. Nevertheless, it seldom accompanies the initial stage, since the eye (owing to its profusion of nerves) is primarily disposed to be over-active. The torpid form usually follows the erethistic form, during which latter the irritability already shows a decrease. Most often it is associated with the terminal period of trachoma; also, as a rule, it makes its appearance in all those forms of logado-blennorrhea which become chronic. The latter happens because no anomaly of secretion can last long without restricting the activity of the nervous system and the vascular system, at least locally. Moreover, trachoma can be long drawn out only when the torpor is milder; in any more advanced stage of development of torpor, when the affected structure suffers an increasing loss of vitality, there necessarily result local colliquations which soon put an end to the process, as the diseased portion undergoes swift destruction.

aa) Local symptoms of torpor. The redness of the diseased conjunctiva has great intensity and has a conspicuous dark blue tint. Also, the outside of the eyelid (not very sensitive or not at all sensitive to being touched) takes on a very dirty, pale violet hue extending from the tarsal edge to the cheek, sometimes to a greater degree and sometimes to a lesser degree. There is no pain at all when the torpid form is fully developed; at most the pains take the form of a feeling of disagreeable pressure. Photophobia either continues only to a very slight degree or is entirely absent. If trachoma patients have suffered from severe photopsia during the synochal or the erethistic form, when torpor ensues their sensitiveness to light becomes plainly less than normal. Seldom do we find the temperature elevated in torpid trachoma. Usually the swelling grows apace; often, indeed, it almost exceeds the bounds of credibility, but it always feels very flaccid, resilient, and doughy to the touch. All movements of the eyelids and of the eyeball, in so far as loss of cohesion of the tissue still permits movements, are exceedingly slow. The volume of secretion is always undiminished, while the secretion is also viscous, dirty looking, and often changeable and highly variegated in color.

bb) General symptoms of the torpid form. The pulse is small, dull, soft, easy to compress, usually too frequent, and sometimes too slow. In patients of this category we find the urine extremely foul-smelling and largely decomposed. The susceptibility of stimulus of the whole body diminishes. The face becomes pale and haggard. Sooner or later, when marked lassitude sets in, exhausting night sweats and frequent liquid defecations make their appearance. In trachoma we almost never see the general condition of health affected except where, in the manner just described, persons with a phlegmatic constitution fall a prey to long sickness and certain deleterious influences.

Chapter III. Simple and composite forms of epidemic and contagious logado-blennorrhea.

Article 79.
a) Simple form of logado-blennorrhea.

Logado-blennorrhea appears in its simple form when all concomitant pathologic symptoms can be satisfactorily explained by the blennorrheal disease of the conjunctiva, and when trachoma not only is absolutely pure but also remains confined to its characteristic site. Accordingly one may recognize only three different subdivisions of simple conjunctival blennorrhea, those which represent its three different stages. Where more accurate nomenclature for individual cases requires it, I shall expand the names of these subdivisions into simple logado-hydrorrhea, simple logado-phlegmatorrhea, and simple logado-pyorrhea (177).

Article 80.
b) Composite forms of logado-blennorrhea.

Conjunctival blennorrhea is composite when, in addition to the essential symptoms of trachoma, there are also symptoms which proceed from other diseases. We can conceive of as many combinations as there are different species of disease in addition to trachoma. Up to the present time experience has shown that many of them have no connection with conjunctival blennorrhea, while others are intimately connected with it. Only the latter complications are of interest here. In order to give a clear outline of these, I shall discuss first of all the composite forms which result from diseases located in other parts of the eye itself. Later I shall discuss those derived from diseases originating outside of the eye.

Article 81.
aa) Conjunctival blennorrhea complicated by diseases in other parts of the eye.

All complications of this category result in part when blennorrhea of the conjunctiva coincides with an analogous disease in other structures of the eye, and in part also when it coincides with a different eye disease having nothing to do with blennorrhea. -

We see three combinations of the first kind. In many cases blennorrhea of the conjunctiva is combined with blennorrhea of the cornea (178); the best name for this complication, developing according to strict laws (179), would be logado-kerato-blennorrhea. Sometimes blennorrhea of the conjunctiva and blennorrhea of the iris appear together; here the symptoms of both the anomalies mentioned are associated with the abovementioned pathologic group, which is properly to be called logado-chorio-blennorrhea (180). Lastly, trachoma can be so extensive that it takes in all the membranes of the eye; we are perfectly justified in giving the name of ophthalmo-blennorrhea consummata to this widespread form, the most destructive one, already described before (181). -

As regards the second type of complication mentioned above, let me point out that, although logado-blennorrheas coincide with all non-blennorrheal eye diseases, they are most often associated (182) with their own sequelae (with subsequent conjunctival loss of cohesion, ectropion, pterygium, ulcers, opacities, staphylomata, et cetera). The reason why the latter complications are observed so very frequently must be sought in the fact that the original process in question, in every more intensive attack upon the structure, usually causes independent secondary diseases

(177) See Article 74.
(178) See Article 60.
(179) See Articles 17, 34.
(180) See Articles 17, 47.
(181) See Article 17.
(182) See Articles 24-52.

earlier in proportion as it has begun to decline independently.

Article 82.
bb) Conjunctival blennorrhea complicated by extra-ocular diseases.

The eyes are intimately connected with the whole body, functionally, both by their anterior covering of skin and by numerous nerves and vessels. This is why the eyeball is so apt to be involved in all diseases originating outside of it, why most eye diseases react on the general state of health so quickly, and why such complications are generally not less varied than common.

Article 83.
α) Conjunctival blennorrhea complicated by congestions of blood toward the head.

The necessity for the constant association of all forms of trachoma with congestion of blood toward the affected part arises precisely from the more copious secretion present (183). Such discharges may vary because of the concurrence of accidental causes (184). We must not, however, consider each of these varied vascular reactions as tantamount to a complication. In other words, if the afflux of blood remains at that stage where the arterial activity is only at the point where trachoma could not otherwixe exist, the congestion appears merely as an integral part of the principal disease. Here the increased vascular activity diminishes with trachoma to such an extent that the former fails to cause any special symptoms.

More severe congestions (in which the arteries of the eye are obviously overactive in proportion to the trachoma present, in which even larger venous trunks in the vicinity are conspicuously involved), on the contrary, manifestly belong among true complications. In the latter circumstances the disordered vascular activity is indicated by special symptoms (which are by no means always connected with trachoma), especially by the following symptoms. The face is warmer, much redder than in health, and often covered with perspiration for hours at a time; marked throbbing of the carotids is never absent; patients complain of painful throbbing behind the ears, in the temples, at the occiput, deep in the orbit, and of a characteristic disagreeable fullness of the whole head. In proportion as fewer of these symptoms are absent and as certain ones are more severe, the greater is the degree of the sympathetic reaction. The influence of the concomitant diseases on logado-blennorrhea is not to be belittled, by any means. Because more active vascular oscillations carry more of the material to the affected organ from that time on, the power of secretion (which apart from this is over-developed in trachoma) develops increasingly, and in this way the disease as a whole is furthered to the highest degree.

Article 84.
β) Trachoma complicated by fevers.

We often see pure inflammatory fever and socalled catarrhal fever associated

(183) See the book by C. F. Graefe, "Angiectasie", 1. c., page 46.
(184) See Article 137.

with trachoma (185). Inflammatory fever is caused by the reaction of the local disease on the body as a whole and therefore has the same characteristics as the general reaction (186). Catarrhal fevers almost never follow the form of trachoma closely. They often begin with the local disease. In many cases they precede it. Sometimes very severe catarrhal fever is seen in mild trachoma, and often it disappears altogether when trachoma reaches its fastigium. Moreover, so long as these combinations continue, we find trachoma accompanied not only by the abovementioned symptoms of simple inflammatory fever (187), but also by all the sufficiently well-known symptoms of catarrhal fever (dryness of the skin, nasal obstructions, pains in the neck, pains in the extremities, sneezing, coughing, et cetera). The effects of pure inflammatory fever as well as catarrhal fever on logado-blennorrhea are always very serious. The former promotes trachoma, just as in the case of more severe congestions, through a more rapid supply of blood (188). The latter furthers trachoma partly in the same way, and partly too because it augments the power of secretion of the conjunctiva by antagonism (189).

Article 85.
γ) Logado-blennorrhea complicated by exanthemata.

Although smallpox, measles, and scarlet fever were present during the campaign, they were never accompanied by trachoma. Probably such complications were prevented by the fact that, generally, two essentially different epidemic and contagious diseases almost never exist simultaneously in the same person (190). The relation of scabies to logado-blennorrhea, on the other hand, was quite different; it was frequently found to be associated with trachoma and always caused much harm to the patients. The conjunctiva, without reserve, is to be considered as an immediate, very delicate continuation of the outer skin. Now, when we consider that, precisely because of that contiguity, when there is any general involvement of the corium it can never remain wholly free from sympathetic reaction, we readily understand why trachoma always appears malignant and stubborn when it affects scabious individuals.

Article 86.
δ) Logado-blennorrhea complicated by abdominal diseases.

Anorexia, nausea, constipation, biliousness, and indigestion often accompanied trachoma. In part they were the result of wrong choice of food (for which war conditions were largely responsible), but in part, too, they were the result of the eye disease itself. We know from the previous articles that the fastigium of trachoma is always accompanied by severe headaches, and, since headaches never fail to upset the ganglionic system of the abdomen, severe trachoma is always sufficient to bring on abdominal disturbances. If the abdominal disturbances were

(185) See the book by J. C. Reil, "Ueber die Erkenntniss und Kur der Fieber", l. c., volume 2, chapter 1.
(186) See Article 75.
(187) See Articles 76-78.
(188) See Article 83.
(189) See Article 152.
(190) See Articles 72, 75.

brought on by improper diet or by that correlation, their reaction on trachoma always proved to be very harmful. Even milder abdominal disorders - merely functional and purely *nervous* - involving the cerebral system cause a marked exacerbation of trachoma. During more serious abdominal anomalies (accompanied by stubborn constipation, by more sluggish excretion from the intestinal tract), the reaction on trachoma is *materially* increased. Trachoma is invariably furthered to the highest degree (191) by the afflux of the blood toward the head in part, and in part by the concomitant over-active secretion of the upper half of the internal mucous membranes [mucosae of eyes, nose, and lungs]. Lastly, since the ocular disorder and the abdominal disorder are apt to cause increasingly severe exacerbations of each other, it devolves on us to pay the greatest attention to this complication at all times.

Article 87.

ε) Logado-blennorrhea complicated by dyscrasia and cacochymia.

Syphilis, gonorrhea, arthritis, and scrofula were often seen to be associated with logado-blennorrhea. That is why many physicians were induced to regard those diseases as the sole cause of trachoma. This theory, however, was disproven on finding that the large majority of persons with trachoma had never suffered from the disorders mentioned. But even if those disorders, accordingly, may by no means be considered as *sufficient* to cause trachoma, on the other hand they had a very decided influence on trachoma. In the dyscrasia mentioned, as in all others, there is vitiation of the lymph, and consequently of the material basis of the whole body. In all such conditions, instead of the mild complication compatible with life and health, there results only the more complicated form, the acute form, corresponding better to the disease (192). Where, therefore, trachoma coincides with any kind of cacochymia, trachoma, too, is very apt to become malignant and as a rule to cause complete destruction of the eye at an early date, and even its milder degrees are hard to cure.

Article 88.

ζ) Logado-blennorrhea complicated by wounds and ulcers.

According to several observations made by me in different hospitals and according to reports (193) received from the directors of the military hospitals at Coblenz and Liége, an obvious correlation exists between logado-blennorrhea and severe suppurations which are sometimes more and sometimes less remote from the eye. This view is supported by the following facts in particular. In general, individuals with larger ulcers - but, in particular, individuals with extensive and inveterate ulcers of the foot - almost never contracted trachoma. When persons already suffering from mild trachoma were wounded, the marked suppuration usually reduced the trachoma so much that it disappeared almost completely. But when such suppurations diminished the trachoma usually recurred. Indeed, in several patients, when the points of suppuration had healed completely, the trachoma affected the eyes worse than originally. Two things follow from all this. First: by no means all soldiers who suffered heavily from trachoma in military hospitals after their wounds and ulcers had healed could attribute it simply to confinement in those hospitals Secondly: suppurations at a distance need not always be specific in nature to produce trachoma by antagonism.

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(191) See Articles 83, 137, 150.

(192) See the book by P. F. von Walther, "Abhandlungen aus dem Gebiete der practischen Medicin", l. c., page 366.

(193) See Fischer's "Bericht", dated Liége, September 6, 1815.
See Wegler's "Bericht", dated Coblenz, September 30, 1815.

Chapter IV. Course of epidemic and contagious logado-blennorrhea.

Article 89.

a) Duration.

The space of time within which incomplete logado-blennorrhea runs its course is brought out by the earlier accounts dealing with the course of the individual stages of development (194). Here, therefore, it is simply a question of ascertaining the course of those forms of trachoma which, having reached the stage of discharge of pus, attain all the degrees of development essential to trachoma. In keeping with this aim, our first duty is to view the factors which determine the duration of the disease in general. As a rule, trachoma is of short duration when highly malignant, when the outbreak of the anomaly is stormy, when the onset of fever is violent, when the disease spreads beyond its characteristic focus at an early date, and when complications are present. On the contrary, trachoma is usually of longer duration in proportion as the minor causes continue to operate over a longer period, as the trachoma is more closely restricted to its original seat, and as it remains more free from complications of any kind. In accordance with the stipulations listed, logado-blennorrhea comes to an end within the following spaces of time, which are sometimes shorter and sometimes longer. -

When the course is peracute, the disease appears only in its most malignant form, owing to very harmful influences and to uncommonly vitiating complications. Here, from the very beginning, as early as the third day, approximately, the disease reaches its peak through bursting of the eye, and all its essential symptoms have already disappeared by the seventh day. -

More often logado-blennorrhea ends favorably as well as unfavorably within a fortnight. But even this cycle, the acute cycle, reaches its height when trachoma is particularly accelerated. -

For the most part logado-blennorrhea which has reached the stage of discharge of pus follows a subacute course and terminates during the fourth, sixth, or eighth week. -

Once trachoma has reached the stage of discharge of pus, it sometimes lasts a very long time, too (three or four months, even several years). The latter evolution - frankly chronic -, however, is seen only where trachoma which has become regressive stubbornly remains in a lower stage, where (owing to malignancy beyond control, or to reactivated secondary diseases) it constantly undergoes intercurrent exacerbations. -

If, after all this, we look back at the discussion of the duration of trachoma which is not fully developed, and at the above discussion of the course of fully developed trachoma, it is clear that trachoma has absolutely no fixed duration.

(194) See Articles 6, 12, 21.

Article 90.
b) Type.

Some physicians speak of intermittent trachoma. There are, however, two reasons why we cannot ascribe genuine intermissions to trachoma in any case. All essential symptoms during trachoma never die out altogether for a certain time, to return regularly within a certain period. At most the sensory affections disappear periodically, but the same does not apply to the anomalies of structure and secretion. -

Sometimes logado-blennorrhea is continuous at the height of its development; however, even here the genuine typus continens (in which all symptoms - pain, fever, discharge, swelling - continue equally) never lasts longer than twenty-four to forty-eight hours. -

Remittent trachoma is the commonest type. During acute trachoma in the advanced stages, the exacerbations are usually seen to begin in the evening, reaching their peak toward midnight and subsiding again toward morning. At first the pains grow worse; shortly thereafter the pulsations of the temporal arteries become more noticeable; later come heat, thirst, sharp accelarations of the circulation, and distressing restlessness. The worst of such acute attacks last for three hours, and even six. Their end is always indicated by more copious discharge of the anomalous secretion, which affords relief. In the mildest attacks, such patients often remain entirely free from pain around noon. Where chronic logado-blennorrhea is without fever and but moderately developed, the daily exacerbations (confined entirely to the eye) begin a few hours after the noon meal has been eaten, and to a large extent pass away in the course of the evening. In these circumstances every single paroxysm is evidenced merely by increased redness of the eye, by annoying itching of the eyelids, by increased photophobia, and by discharges which are more copious and less mild. The fact that exacerbations of protracted logado-blennorrhea always coincide with the period of digestion (with that very period during which the whole internal cost of skin is stimulated) signifies how much trachoma depends on the connection which exists between the conjunctival tissue and the major internal mucosal covering (195).

Article 91.
c) Stages.

Every single kind of trachoma sui generis, whether mild or well advanced, consists of five periods: onset, increase, fastigium, regression, and convalescence. Since each of the individual stages of development (already discussed before) has different symptoms (196) while the periods themselves are alike whether trachoma is mild or more advanced, the periods cannot by any means be identified by any given syndrome, but solely by the correlation of the symptoms.

aa) The stadium principii is the period during which a few signs of incipient logado-blennorrhea - as yet totally unrelated - are present, during which those signs sometimes disappear and sometimes return without rhyme or reason. Usually this period is evidenced by mild symptoms of watering which vary widely. The initial period has no fixed length; its duration is short where the course of trachoma is acute and long where the course of trachoma is chronic. In the first instance watering lasts but few hours or days; in the second instance, on the contrary, it lasts several weeks.

(195) See Articles 149-151.
(196) See Articles 2-23.

bb) The stadium incrementi comes midway between the onset and the fastigium of the disease. Here we no longer find any essential symptom missing. Here the anomaly proves to be, in general, not only well established but at the same time also obviously trying to reach more advanced stages. The limits of this period of the disaase appear to be very elastic, in concrete cases. This period, for the most part, takes in watering alone; often, too, it embraces the discharge of mucus; and occasionally it even includes the discharge of pus. Consequently all the symptoms of the three stages of development can occur during this period. They represent signs of actual increase only when (during individual exacerbations following one another) they gain in intensity and extent. The time within which the increase takes place varies widely. In many individuals the anomaly increases over a period of weeks, even months, before it reaches its peak; in other persons the peak is reached in but few days. The same conditions which, in general, produce the acute or chronic form of logado-blennorrhea also determine the course of this period (197).

cc) The stadium fastigii begins when the period of increase ends and stops where trachoma begins to regress. During the fastigium, the symptoms of every single exacerbation and the symptoms of the succeeding remissions show no difference in extent and intensity. I must point out that the course of this period of trachoma, as in the other periods, is by no means of a definite length. Sometimes the end of trachoma came so soon that the fastigium was over after but few hours, owing to a severe attack of fever, copious perspiration, very hypostatic urine, marked diarrhea, a sudden and unusual increase in the discharges from the conjunctiva, or rhegma bulbi. In the majority of cases this period lasts for several days. In many cases it is so long drawn out that the paroxysms continue at the same level for weeks before any noteworthy decrease ensues.

dd) The stadium decrementi immediately follows the fastigium and ceases with the disappearance of all the essential symptoms of trachoma. Here every succeeding exacerbation appears milder and shorter than the one immediately preceding it. Here not just a few symptoms but all symptoms decrease uniformly. Here, after the anomaly has become fully developed, it manifestly regresses to the milder degrees. Here patients notice that their eye is more and more comfortable from this time on, until finally all the distinctive features of the anomaly vanish.

ee) The stadium reconvalescentiae begins when the essential symptoms of the disease have passed away, and lasts until the eyes regain their strength. In this period the tissue, freed from blennorrhea, still lacks the necessary tone; during it, therefore, convalescents cannot strain their eyes by writing or reading and by doing other similar work without noticing fatigue or unpleasant oppression in the eyeball shortly afterward. In these circumstances the organ of vision likewise reacts too violently; exposure to sharp air and strong light and consumption of highly seasoned food and drink are therefore immediately followed not only by more severe lacrimation but also by reddening of the whole conjunctiva. Generally speaking, if the disease has reached more advanced stages, this condition lasts longer in proportion, for the most part. If the previous development has been quite uncomplicated but the disease has reached the stage of discharge of pus, convalescence usually takes two to four weeks. Only after mild discharge of mucus and watering does the eye regain its full strength earlier.

(197) See Article 89.

Chapter V. Diseases to which trachoma is related.

Article 92.

A. Relation of epidemic and contagious logado-blennorrhea to the other blennorrheas.

Logado-blennorrhea does not always appear in its epidemic and contagious form. Commonly we see it in another form utterly devoid of contagiousness and resulting from different causes not to be numbered among contagions. Depending on whether the latter causes act on merely a few individuals or on whole groups of people by means of definite local conditions or atmospheric conditions, trachoma also makes its appearance in sporadic, endemic, or epidemic form. The abovementioned epidemic and contagious logado-blennorrheas (which are produced by a special virus of infection which thrives in certain climates) differ from the other blennorrheas chiefly in the following respects. The weaker virus of the latter [in terms of botany] produces delicate shoots, and at most shoots with luxuriant foliage; the former, as a rule, develop into seed-bearing blossoms by means of far more active growth (198). In order to make both the dividing line between those conditions and their mutual transitions as clear as possible, for purposes of accurate comparison, I must supplement the previous account of epidemic and contagious trachoma by a more detailed study of all the other varieties of trachoma.

Article 93.

B. Sporadic trachoma traced from its mildest form to its transition into the epidemic and contagious form.

Since we find these blennorrheas belonging in part to diametrically opposed categories of disease, it is utterly impossible to arrange them without violating the canons of individual nosographers. For the many erroneous judgments passed on several of these conditions I blame their widely differing degrees of extent and intensity. The latter, owing to their different forms, are of course easily regarded as so many varieties arising from many types of disease, when sufficient proof is lacking. For purposes of more comprehensive grouping, the varieties affecting the palpebral conjunctiva exclusively are to be separated from those extending to the eyeball.

Article 94.

a) Sporadic blepharo-blennorrhea.

So long as the blennorrhea does not extend to the bulbar conjunctiva but remains confined to the eyelids, it can continue over a long period without harming the eye in any way. All the diseases of this kind (which differ widely in development) are divided into two main groups, into partial and into total blepharo-blennorrheas, depending on whether they invade the tissue of the palpebral conjunctiva only in part or in toto.

(198) See Article 63.

Article 95.

aa) Partial blepharo-blennorrheas.

At the corners of the eye, where the conjunctiva does not cover the eyeball first but immediately proceeds from the lower eyelid to the upper eyelid, it shows a much greater capacity for secretion, as does every cutaneous region located at curvatures. Along the tarsus the conjunctiva appears to be formed mostly of mucosa, owing to its intimate connection with the Meibomian glands. For both reasons these parts of the palpebral conjunctiva are the ones most exposed to trachoma. Now, since trachoma can be restricted to either the former or the latter parts of the conjunctiva, owing to special predisposition arising at those very places, every partial blepharo-blennorrhea develops either as blepharo-blennorrhea of the angle, or as blepharo-blennorrhea of the tarsus.

Article 96.

α) Blepharo-blennorrhea of the canthus.

Blennorrhea of the canthus, according to several cases carefully studied by me, is divided into three different varieties, owing to its developeent sometimes as watering, sometimes as the discharge of mucus, and sometimes as the discharge of pus. But, since the first two degrees of development were usually grouped together, only two degrees instead of three were adduced by all physicians. This classification, which at one time was customary, has been preserved in the following discussion simply because I did not wish to depart from accepted usage without the most urgent necessity.

Article 97.

αα) Lemositas.

Lemositas Hippocratis, lemia, lemae, lippitudo angularis, and impurity of the canthus are synonyms of watering or the discharge of mucus which affects merely that portion of the conjunctiva adjacent to the canthi. All manifestations of watering or the discharge of mucus (particularly non-vascular redness, imperceptible loss of cohesion on the part of the tissue, annoying itching, and serous or mucous secretions) appear only at the regions of the conjunctiva mentioned (199). The reason why lemosity is commoner and severer at the larger internal canthus than at the external canthus is as follows: generally speaking, the greater tendency toward trachoma (200) shown by both canthi is increased still more at the internal canthus, because there the conjunctiva meets the glandulous caruncle. For the most part, lemosity takes on a torpid character. Because the process is not very extensive or intense, it can persist in its characteristic form for a very long time (several months, even some years) without impairing vision. Usually it is sporadic, sometimes it is endemic, but it is never purely epidemic or epidemic and contagious.

(199) See J. G. Beer, 1. c., 1792 edition, volume 1, page 60, and volume 2, page 466.
See Schmidt, 1. c., volume 3, pages 35 and 37.
See Lefebure de Saint-Ildefont, 1. c., page 210.

(200) See Article 95.

Article 98.
ββ) Peribrosis.

The names of peribrosis, perivrasis, and scabies of the canthus are given to lemosity which has advanced as far as the discharge of pus (201). Here, although the secretion is already intensive, it is not yet increased in extent. Here the canthi present genuine discharges of pus and manifest development of papillae. Because several papillae protruding from the diseased tissue touch one another, this disease tends to have fusion of the canthus as sequela, when conditions are favorable. Moreover, peribrosis is just like lemosity as regards its character, duration, and etiology.

Article 99.
β) Marginal blepharo-blennorrhea.

Blennorrhea of the tarsus is present in all three degrees of development characteristic of the pathologic process. Here, too, as in blennorrhea of the canthus (202), the stages of watering and the discharge of mucus have been classed together. That is why we then find, according to this practice, that whether or not the stage of discharge of pus has been reached, only two varieties of marginal blennorrhea have been described conventionally.

Article 100.
αα) Lippitudo simplex.

Lippitudo simplex, lippitudo arida, lippitudo sicca, lippitudo crystallifera, epiphora sebacea, gramia, and simple blear-eye are synonyms of watering or the discharge of mucus which involves the tarsus primarily (203). For the most part these anomalies originate along the entire margin of the lids, but sometimes, too, they develop from blennorrhea of the canthus. The socalled lippitudo simplex is exactly like lemosity and peribrosis as regards form, duration, and all etiologic factors (204). The only other point to mention is that several special adjectives are applied to lippitude to denote its different causes. Thus, for instance, the term lippitudo senilis means that the disease results from changes which the body suffers in old age, and the term lippitudo cachectica means that the disease is connected with dyscrasias (205).

(201) See Lefébure de Saint-Ildefont, 1. c., page 210.
See G. J. Beer, 1. c., 1813-1817 edition, volume 1, page 292.
(202) See Article 96.
(203) See the book by J. C. Reil, "Memorabilium clinicorum", 1. c., Fasc. I, pages 50 and 116.
See J. G. Beer, 1. c., 1792 edition, volume 1, pages 110 and 146.
See G. J. Beer, 1. c., 1813-1817 edition, volume 1, page 290.
(204) See Articles 97-98.
(205) See the book by J. C. Reil, "Memorabilium clinicorum", 1. c., Fasc. I, page 112.
See the book by P. F. von Walther, "Medicinische Beobachtungen", 1. c., volume 1, page 458.

Article 101.
ββ) Lippitudo ulcerosa.

The names lippitudo ulcerosa, inflammatio palpebrarum excoriata, lippitudo pruriginosa, and palpebral scabies can be donsidered as synonyms of those blennorrheas constituted by discharge of pus from the tarsal portion of the conjunctiva (206). Because the coating of epidermis disappears in this condition (owing to the development of granulations), lippitudo ulcerosa is apt to be followed by different very troublesome sequalae. In other words, if the lippitudo ulcerosa is seep-seated, it gives rise to agglutinations of the eyelids sometimes, to deformities of the tarsus sometimes, and to deviation or to complete loss of the eyelashes sometimes. Like the abovementioned varieties of blennorrhea, the present variety also usually receives special names to denote special causes. In this respect certain physicians derive the names of psorophthalmia and lippitudo herpetica not from a possible resemblance of this eye disease to the scabies in question, but solely from cases where lippitude depends on general scabious or herpetic affections (207).

Article 102.
bb) Total blepharo-blennorrheas.

Although complete blepharo-blennorrhea (the kind which attacks the palpebral conjunctiva in its entirety) is primary in origin for the most part, it also follows further extension of the abovementioned partial form sometimes. Usually it is divided into two varieties, depending on whether the secretions discharged during it are serous on the one hand, or sometimes like mucus and sometimes like pus on the other hand. The first variety is called ophthalmia serosa and the second ophthalmia glandulosa. Here almost all physicians group the serous stage apart but group the mucous stage and the purulent stage together for the following reason. Only in its earliest stages is socalled total blepharo-blennorrhea long drawn out; when it reaches the stage of discharge of mucus, on the contrary, it soon passes on to the frank discharge of pus, as a rule.

Article 103.
) Ophthalmia serosa.

Ophthalmia serosa, ophthalmia souta humida, and ophthalmia catarrhalis are synonymous with that blennorrhea involving the whole palpebral conjunctiva, where the disease appears only in the form of watering (208). Several authors have made the mistake of classing this disease with simple inflammations (209). In order to distinguish it clearly from other eye diseases, I shall amplify its name into blepharohydrorrhoea completa. Here the bulbar conjunctiva is as yet untouched by true blennorrhea; at most it suffers sympathetic reaction, as evidenced by a somewhat dirty-looking color and a few crimson minute vessels visible in it (210). During the outbreak of this disease patients complain of dryness and roughness in the eye, and of the feeling that dust or sand has gotten under the eyelids (211). Because of these symptoms several nosographers mistakenly supposed that there was actual dryness of the eye, and consequently termed the anomaly sclerophthalmia, xerophthalmia, xerophthalmus, and ophthalmia sicca (212). However, since those feelings never result from a deficiency of the ocular fluids but solely from the special roughness of the palpebral conjunctiva accompanying the formation of granulations (213), the terms listed are by no means to be regarded with approval.

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(206) See Schmidt, 1. c., volume 3, page 33.
See Lefébure de Saint-Ildefont, 1. c., pages 157 and 165.
See J. G. Beer, 1. c., 1792 edition, volume 1, page 65, and volume 2, page 463.

(207) See the book by P. F. von Walther, "Medicinische Beobachtungen", 1. c., volume 1, page 471.
See Lefébure de Saint-Ildefont, 1. c., page 165.
See J. G. Beer, 1. c., 1792 edition, volume 1, page 65.

(208) See the book by J. C. Reil, "Memorabilium clinicorum", 1. c., Fasc. I, page 113.
See A. G. Richter, 1. c., third edition, volume 3, page 45.
See Lefébure de Saint-Ildefont, 1. c., page 12.
See G. J. Beer, 1. c., 1813-1817 edition, volume 1, page 288.

The course of the disease at this degree of development is no longer chronic for the most part (as is the course of partial blepharo-blennorrhea), but, owing to the widespread state of the disease, acute for the most part. Only when patients have a good physique and circumstances are wholly favorable does this condition end in immediate recovery. When dyscrasias are present, just as when there are extremely baneful external influences, recovery almost never takes place until more advanced degrees of intensity have intervened. There is ample corroboration that total blepharo-hydrorrhea is not only sporadic and endemic, but sometimes also epidemic. The epidemic form is most apt to appear in climates where larger groups of people suffer from catarrh (214).

Article 104.
β) Ophthalmia glandulosa.

The terms ophthalmia glandulosa, blepharophthalmia, blepharo-blennorrhea, and blepharadenitis are employed to denote palpebral beennorrheas in which either muccus or purulent secretions are discharged (215). I have already explained why most physicians frankly group both these varieties under one head (216). Were we to

(209) See Articles 54-55.
(210) See Article 4.
(211) See Articles 5, 11.
(212) See A. G. Richter, 1. c., third edition, volume 3, page 16.
See G. J. Beer, 1. c., 1813-1817 edition, volume 1, page 288.
See the book by P. F. von Walther, "Medicinische Beobachtungen", 1. c., volume 1, page 383.
See Schmidt, 1. c., volume 3, page 35.
(213) See Articles 5, 11.
(214) See Hoffmann, 1. c., Suppl. II, P. II, page 74.
See A. G. Richter, 1. c., third edition, volume 3, page 45.
See Bose, 1. c., page 11.
See Jourdan, 1. c., page 417.
(215) See Schmidt, 1. c., volume 3, page 35.
See the book by J. C. Reil, "Memorabilium clinicorum", 1. c., Fasc. I, page 49.
See J. G. Beer, 1. c., 1792 edition, volume 1, page 40.
See G. J. Beer, 1. c., 1813-1817 edition, volume 1, pages 305-312.
(216) See Article 102.

subdivide ophthalmia glandulosa according to the well defined stages of development which actually occur, we could call its milder stage blepharophlogmatorrhoea completa and its more advanced stage blepharopyorrhea completa. These stages of the disease always develop from primary blepharo-hydrorrhea.

During this anomaly (which may be sporadic, endemic, or purely epidemic), although the bulbar conjunctiva always shows sympathetic inflammation, it seldom does so to the extent that it does when such diseases are epidemic and contagious (217). If this eye disease is long drawn out, it invariably causes many secondary anomalies of the bulbar conjunctiva and of the palpebral conjunctiva. Sequelae affecting the bulbar conjunctiva (owing to intermittent protraction of sympathetic taraxis) are then phlyctenae, opacities, pterygia, or ulcers (218). Here, when the blennorrhea is deep seated, the eyelids suffer completely idiopathic loss of cohesion in the conjunctiva on some occasions, and various kinds of ectropion (sometimes unusually deforming) on other occasions. As regards the latter sequelae (almost never absent in very chronic blepharo-pyorrhea), this disease was also called "trachoma", sycosis, dassymma, and palpebra ficosa, because of the similarity of the rough, punctate, reddened palpebral conjunctiva to the pulp of a fig ripe to bursting.

Many writers add special adjectives to ophthalmia glandulosa to denote its various causes. This happens particularly in the case of ophthalmia glandulosa scrophulosa and ophthalmia glandulosa venerea. The former variety is evidenced by many vascular ectasias of the outside of the eyelid which are associated with it, by relapses of very frequent occurrence, and by the appearance of its exacerbations regularly in the morning. According to Reil (219) the latter variety, whose course is very chronic, is always accompanied by discharges of pus, by pains recurring regularly at night, by numerous corneal opacities, and by destructive palpebral ulcerations. As the result of the abovementioned conditions, owing to which blepharo-hydrorrheas are present in many persons at the same time, blepharc hlegmatorrheas and blepharo-pyorrheas can also affect a large number of individuals simultaneously (220). Where the disease continues to advance steadily because of persistent untoward influences of any kind, it finally turns into genuine ophthalmo-blennorrhea. Such transitions, however, occur for the most part in sporadic, endemic, and purely epidemic palpebral blennorrheas much less often and much more slowly than in blepharo-blennorrheas which were originally caused by the epidemic and contagious form.

Article 105.
b) Sporadic ophthalmo-blennorrheas.

The terms oculus purulentus, ophthalmia purulenta, and chemosis blennorrhoica (221) are synonyms of blennorrhea which extends over the whole conjunctival tissue. Since this degree of extension goes through three stages of intensity, it, too, is divided into three different varieties, ophthalmo-hydrorrhea, ophthalmo-

(217) See Articles 10, 16.
(218) See Articles 30-43.
(219) See the book by J. C. Reil, "Memorabilium clinicorum", 1. c., Fasc. I, page 67.
(220) See Article 103.
(221) See Schmidt, 1. c., volume 3, pages 35 and 124.
See Ware, 1. c., pages 10, 98, 126, and page 2 of Appendix.

phlegmatorrhea, and ophthalmo-pyorrhea. The distinctions between these evolutions are readily perceived when the anomaly is chronic; we find them less definite as soon as the disease advances rapidly (222). Ophthalmo-blennorrheas always develop from blepharo-blennorrheas. Such a transition is to be expected all the earlier in proportion as blepharo-blennorrheas are accompanied earlier by numerous vascular ramifications of the bulbar conjunctiva, by severe photophobia, and by piercing orbital pains. This form of the disease, too, has received several names denoting specific causes; it is designated principally by the terms ophthalmia neonatorum, blepharophthalmia arthritica, ophthalmia glandulosa variolosa, and ophthalmia gonorrhoica (223).

All sporadic, endemic, and epidemic ophthalmo-blennorrheas, when they have reached well advance stages and when conditions are favorable, can finally turn into the most complete ocular blennorrheas accompanied by the production of a special virus of contagion. A good argument in support of this view is the following often observed fact. Ophthalmo-blennorrheas which affected merely a few individuals over a rather long period were not at all contagious. But, in overcrowded and unsanitary institutions, the virulence grew steadily; and suddenly, owing to a manifestly increased power of contagion, the spread of the ophthalmo-blennorrheas was hastened in porportion to their severity (224).

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(222) See Article 17.

(223) See G. J. Beer, 1. c., 1813-1817 edition, volume 1, Articles 561-564, 513, 532.

(224) See Articles 63-71, 92, 158-159.
See the letter of Sir William Adams in the Journal der Chirurgie und Augenheilkunde, volume 1, pages 170-176, number 1, 1820.
See Chaussler's interesting experience, quoted by Jourdan, 1. c., page 420.
See Macgregor, 1. c., pages 30-44

Book Three. History

Chapter I.

Presence of epidemic and contagious trachoma in the orient, the earliest date of its occurrence, and its persistence in Egypt down to the present century.

A. Proof of epidemic logado-blennorrhea prior to the Christian era.

Article 106.

The works of Hippocrates very definitely show that there were epidemics of trachoma even in the remotest times. In several passages of these classic chronicles (compiled circa 400 B. C.) trachoma is designated by the name of ὀφθαλμία ῥοώδης [violent running of the eyes] and sharply differentiated from all other eye diseases, even at that early date (225). In the Βιβλίον προῤῥητικόν [Book on Prorrhetics] we find graphic descriptions (226) of the following: the characteristic anomalies of structure, secretion, and sensation; the causes of the different duration, sometimes up to the seventh day, and sometimes up to the sixteenth day; and the myriad aspects of this disease (including its favorable termination by crisis as well as its unfavorable termination by bursting of the eyeball, by ulcers, opacities, and ectropion). Furthermore, in the book Περὶ ἀέρων... [Airs, Waters, and Places] it is firmly established that trachoma very often takes the form of νόσημα πάγκοινον [a disease common to all], and that, in the main, general causes help to make it a general occurrence; such causes are steady cold winds, damp climate, and the autumn season (227). Indeed, in the book Περὶ ὄψιος [Vision] we find a detailed account of how annually recurring epidemic logado-blennorrhea is to be cured by venesection, purgation, excluding light, and eating sparingly (228).

To this weighty evidence must be added that not uninteresting account which has been preserved through the masterly description of the expeditions of the younger Cyrus. In other words, Xenophon relates that, during the retreat across the Euphrates and Tigris, a severe eye disease broke out among the Greek troops as the result of exhausting efforts, frequent changes in temperature, and unwonted cold; within a short time this disease had affected an unusually large proportion of the men (229). Although the imperfect description of the symptoms makes it impossible to be absolutely sure of the nature of the disease which took place here, the law of analogy permits the conjecture that the disease was a variety of blennorrhea.

B. Status of epidemic and contagious logado-blennorrhea after the birth of Christ.

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(225) See Hippocrates, "Opera omnia", l. c., Sect. II, page 154, E-G; Sect. III, page 282, lines 20 and 30; Sect. VII, page 943, D-H.

(226) See Hippocrates, "Opera omnia", l. c., Sect. II, Page 101, G-H; page 102, A-H; and page 103, A-B.

(227) See Hippocrates, "Opera omnia", l. c., Sect. III, page 281, lines 54-57; page 282, lines 1-10; page 287, line 10.

(228) See Hippocrates, "Opera omnia", l. c., Sect. V, page 689, lines 20-30.

(229) See Xenophon, l. c., Lib. IV, Cap. 5, Articles 12-14, page 139.

Article 107.

Celsus and Galen, who lived in the first and second centuries A. D., found no reason to depart from the older dogmas concerning trachoma. Both borrowed the symptomatology word for word from the Hippocratic writings, to a large extent. However, Celsus distinguishes the discharge of pus more definitely from watering and the discharge of mucus (230), and Galen discusses the causes of trachoma in greater detail. Galen (231) comments particularly on several of the abovementioned (232) aphorisms of Hippocrates dealing with the harmful atmospheric influence. Not only does Galen make highly instructive comments; he also affirms that trachoma is highly contagious, in that he condisers the contagion of trachoma equal to the contagion of epidemic malignant fever (233).

Article 108.

The writers of the sixth and seventh centuries are much inferior to the earlier writers as regards description of the clinical picture. I shall mention by name only Aetius of Amida (234), Alexander of Tralles (235), and Paul of Aegina (236). They neglected to describe the symptoms accurately, their treatment of most of the etiologic factors was too superficial, and they devoted their entire energy to the collecting of a host of complex remedies which can hardly be observed at a glance. Accordingly, the literary legacy left by these physicians is only of slight value for research in the field of history. But, because they recommend numerous eye lotions and eye salves to counteract various forms of logado-blennorrhea, it is at least possible to conclude that the disease was a very common occurrence in their day.

Article 109.

Through Avicenna, who lived at the end of the tenth century and at the beginning of the eleventh century, we again obtain very vital information. This author, whose works were wide in scope, profiting by the earlier works of Hippocrates and Rhazes, gives a very clear picture of the disease as it actually occurred. He gives an admirable account of the individual causes of logado-blennorrhea. He points out: that it is usually more prevalent in southern regions than in northern ones; that it becomes much worse in hot weather; and that it becomes widespread partly as the result of definite atmospheric influences but partly, too, like smallpox and malignant fever, as the result of a special virus of contagion emanating from patients (237).

After the time of Avicenna, when the cultivation of medical science shifted from the orient to the occident, when it began to flourish in Italy and France, when Greece and Arabia no longer produced any important authors, when public instruction was confined almost wholly to Europe, satisfactory discussions of logado-blennorrhea became increasingly scarce. The subject of blennorrhea of the eye is patently slighted in the later chronicles, but they offset this neglect by giving up a detailed description of pure, genuine, inflammation of the eye. Probably

(230) See Celsus, l. c., Lib. VI, page 286.
(231) See Galen, l. c., volume 7, pages 77, 79, 82, 90.
(232) See Article 106.
(233) See Galen, l. c., volume 3, page 116, line 3.
(234) See Aetius of Amida, l. c., Lib. VII.
(235) See Alexander of Tralles, l. c., Lib. II, Cap. 1, 3, 4, 5.
(236) See Paul of Aegina, l. c., Lib. III, Cap. 22.
(237) See Avicenna, l. c., L. III, Fen. III, Tractat. I, Cap. 5, 6, 7; Lib. I, Fen. II, Doctrin. I, Cap. 8, E-F.

this situation was reversed because the physicians of the school which had recently gained prominence, living in a more temperate climate which was less favorable to profluvia of all kinds, saw blennorrhea of the eye seldom and saw it only when mild, but saw pure inflammation of the eye frequently and saw it in far more advanced stages.

Article 110.

Although the older European medical writers make little mention of logado-blennorrhea in some cases, and absolutely no mention of it in other cases, according to eyewitnesses this disease continued without interruption in the orient (238). It is plain to see from several histories dealing with the sixteenth century that trachoma was present in the orient, in the plains of Egypt. There (owing to the great heat, the high humidity, and the rapid changes in temperature) it thrived best; it not only continued to be present but also was often (indeed, particularly during the spring and autumn months) so extensive that out of a hundred inhabitants hardly fifty had good eyes (239).

Article 111.

The most recent reports on the presence of logado-blennorrhea in Egypt were occasioned by Napoleon's bold campaign undertaken at the end of the eighteenth century. During it (between the years 1798 and 1804) French, Italian, and English physicians had a golden opportunity to observe this disease in Egypt. The most instructive reports are those by Assalini, Larrey, Frank, and Vetch (240). Although these writers differ widely in the matter of naming the disease, they agree perfectly in essential matters (when all incidental elements are omitted from their descriptions). According to the sources just mentioned, Egyptian ophthalmia is exactly like European ophthalmia, as shown by the following symptoms chiefly.

During the first period of the disease (during which patients complain of feeling as if grains of sand had lodged under their eyelids), frequent lacrimation, photophobia, and unusual redness of the inside of the lid (hydrorrhea) are noticed. Next appear vascular ectasias in the bulbar conjunctiva, discharges of a somewhat thick secretion, and transitory darting pains in the eye (progressive phlegmatorrhea). Later (when there is marked palpebral edema and severe pains occur, usually growing worse during the night) a purulent fluid, in no way distinguishable from pus, is discharged from the eyes (blepharo-pyorrhea). Finally the pathologic process, on reaching its fastigium, involves the eyeball. Here the crimson bulbar conjunctiva distends without visible vascular distribution, as if forming a wall about the entire cornea. Here excruciating pains dart through the forehead at first and shortly afterward affect the whole head. Here there are acute attacks of fever accompanied by delirium. Here, in the space of twenty-four hours, the eye discharges pus often amounting to several ounces, until the disease either regresses or terminates by bursting of the eyeball (ophthalmo-pyorrhea). -

As regards the tendency toward different forms shown by trachoma, it, too,

(238) See the German translation of the French text of Volney, l. c., volume 1, page 186.
See the letter of Sir William Adams in the Journal der Chirurgie und Augenheilkunde, volume 1, pages 170-176, number 1, 1820.

(239) See Alpini, l. c., pages 24a, 46b, 98a.

(240) See Assalini, l. c., pages 103-105, 121.
See Larrey, l. c., volume 1, pages 203-205.
See the German translation of the French text of Frank, l.c., pages 48-56.
See the German translation of the English text of Vetch, l. c., pages 18-45.

obtains on the banks of the Nile just as in Europe (241). Larrey states particularly that there are inflammatory as well as serous forms of logado-blennorrhea (242). Under inflammatory ophthalmia he includes both the synochal and the erethitic forms; under serous ophthalmia he includes the torpid form of this disease. That aspect is brought out still better by Savaresi, since he frankly recognizes sthenic as well as asthenic tendencies of trachoma (243). Indeed, even the writings of those physicians who fail to make a sharp distinction between the forms of trachoma show plainly that in the orient trachoma is sometimes synochal, sometimes erethistic, and sometimes torpid (244). -

Almost all observers unanimously agree that even in warmer climates this anomaly has no fixed duration, that even there its common duration is seven days but that sometimes it also lasts for several months (245). -

The commonest sequelae of trachoma in Egypt are said to be primarily a marked tendency toward recurrences, ectropia fungosa, corneal opacities, staphylomata, cataract, amblyopia, and amaurosis (246). -

Several authors mention the widespread occurrence of trachoma among the natives. Larrey relates that this disease is extremely common in Egypt (247). Assalini saw the disease revail almost steadily in that country (248). According to Volney (249), while walking through the streets of Cairo during the vernal equinox one often meets, out of a hundred persons, twenty blind ones, ten one-eyed ones, and twenty others whose eyes are red, purulent, or affected with spots. Bruce (250) counted twenty-five thousand eye patients in the hospitals of Cairo alone. -

Many causes are blamed for the special frequency of trachoma in Egypt. There is proof that in the remotest times the disease was not quite so devastating there as in the latter centuries. Volney, Olivier, and Kluyskens give as the reasons for this the increasingly neglected tilling of the soil and the native custom (purely a late development) of wearing warm head coverings (251). Much blame is attached to the circumstance that the eyes constantly suffer harmful irritation partly from the heavy clouds of very fine dust (resembling chalk and containing sal ammoniac) raised, partly from bring effluvia of salt water, and not less from the dazzling sunlight reflected by the white sand. Two primary causes (252) are to be numbered among those mainly responsible for general propagation of trachoma: the regularly recurring overflow of the Nile; and the sharp contrast between the days (dry and very hot) and nights (foggy, damp, and cold). Lastly, according to the testimony of most physicians, it is also evident that by no means all Egyptians show the same tendency to contract trachoma. In other words, on the whole, the first to contract trachoma are: men and women with blond hair; the offspring of parents who have had trachoma in the past; persons with scrofula; and persons who are poor, badly nourished, and completely at the mercy of the hardships inflicted by the climate. On the contrary, the upper classes and the free natives of the country remain conspicuously immune from trachoma (253).

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(241) See Articles 75-78.
(242) See Larrey, l. c., volume 1, page 204.
(243) See Savaresi, quoted by Chamseru, l. c.
(244) See the German translation of the English text of Vetch, l. c., pages 18-45, and especially pages 28, 32, 70.
See tje German translation of the French text of Frank, l. c., pages 48-56.
(245) See Assalini, l. c., pages 97, 98, 122, 123.
See Larrey, l. c., volume 1, pages 204 et seq.
See the German translation of the English text of Vetch, l. c. page 21.
See Article 89.
(246) See Assalini, l. c., pages 105, 117, 120, 121.
See Larrey, l. c., volume 1, pages 205, 207, 208.
See the German translation of the English text of Vetch, l. c., pages 34, 35, 37, 50, 71, 72.
(247) See Larrey, l. c., volume 1, pages 202, 203, 217, 218.
(248) See Assalini, l. c., page 97.
(249) See Volney, quoted by Chamseru, l. c., or the German translation of the French text of Volney, l. c.
(250) See Bruce, quoted by Chamseru, l. c.
(251) See the German translation of the French text of Volney, l. c., volume 1, page 189.
See Olivier, l. c., volume 2, page 144. See Kluyskens, l. c., I-VIII.

Chapter II.

History of epidemic trachoma among the French troops from 1798 to 1801, caused by the Egyptian campaign.

Article 112.

The logado-blennorrhea which constituted no minor obstable to the army of Napoleon in Egypt was exactly like the ophthalmia suffered by natives of Egypt as regards the primary symptoms and the sequelae, according to Larrey and Assalini. Now, since all aspects of the symptoms of the epidemic among the Egyptians have been fully discussed in the preceding chapter, I refer the reader to it for the symptoms of the eye disease which attacked the French army in the orient (254).

Article 113.

The following points are noteworthy as regards both the special causes and the peculiar course of this epidemic.

The disease broke out among several individual regiments as soon as the army (numbering about thirty-two thousand men) had landed, in July of 1798, and continued steadily (assuming almost epidemic proportions) as long as the army remained in Egypt, up to August of 1801. Not every division of the army was affected with trachoma to the same degree. Most of the cases occurred among the army which had taken up its

(252) See the German translation of the French text of Volney, l. c., volume 1, pages 187-188.
See Assalini, l. c., pages 105, 112.
See Larrey, l. c., volume 1, pages 203, 206, 208-209.
See Chamseru, l. c.
See the German translation of the French text of Frank, l. c., pages 64-69.
See Macgregor, Whyte, and Edmonstone, quoted on pages 4-18 of the German translation of the English text of Vetch.

(253) See the German translation of the French text of Volney, l. c., volume 1, pages 187-188.
See Assalini, l. c., page 129.
See Larrey, l. c., volume 1, pages 206, 209.
See Chamseru, l. c.
See the German translation of the English text of Vetch, l. c., pages 10, 44, et seq.

(254) See Articles 110-111.
See Larrey, l. c., volume 1, pages 204-216.
See Assalini, l. c., page 105.

position along the banks of the Nile, among the soldiers who remained in the delta, among the French of the Desaix division (though constantly embarked upon the Nile in Upper Egypt), and among the sappers appointed to build the flying bridge between Giza and the island of Rhoda. In addition, all the wounded occupying quarters improperly roofed over in the hospitals of Cairo, or lying very close to draughty windows when the Nile overflowed, often suffered worse from their eyes than from the wounds which sent them there. Generally speaking, the fact that several special hospitals for eye patients had to be erected at Cairo, Giza, and Rosetta show how many trachoma patients there were (255).

On the whole, the epidemic during the year 1798 (that is, during the first year after landing) not only appeared in its most virulent form but was also, at the same time, so widespread that hardly a soul in the army escaped eye trouble. At this very time, however, obviously the worst sufferers were also all soldiers, owing to severe exertions, to unusually hurried marches, and to their ignorance of how to protect themselves against the varied untoward effects of that climate. -

Trachoma was seen more seldom and in milder form in the year 1800. This was partly due to the curtailed activities of the army corps, to the knowledge of the influence of the climate which every single person had gained by experience, and to the precautions taken in an attempt to protect the soldiers against cold at night as much as possible by issuing warmer clothing. -

Trachoma raged again in the spring of the year 1801, when the army proceeded to Alexandria for the purpose of repelling the English who had landed, when the troops (carrying out the very strenuous work of intrenchments) were exposed to the inclement weather which had set in. The worst sufferers during the latter period were the divisions stationed upon the shore of Lake Mareotis. Recurrences were now suffered by nearly all soldiers who had survived earlier severe attacks, but above all by the weaker men. The extent of the recurrence of logado-blennorrhea at this time is plainly shown by the fact that, within two and a half months, approximately three thousand eye patients were admitted to military hospitals. No diminution of this exacerbation now appeared until August of the same year, when, following the capitulation which had been concluded, the army began to embark for France.

Article 114.

During the return voyage of the army the disease abated considerably. Many of the patients were entirely free from blennorrhea even at their departure. Many who had corneal speaks improved so much, even before their arrival in France, that soon after landing hardly any traces of corneal opacities could still be seen. Indeed, several of the individuals who had been reported as invalids in Egypt, on account of their eyes, returned to active service after they had lived in France for some time (256). According to the instances quoted and to Larrey's positive assurance (257), the disease transported from the banks of the Nile undoubtedly lost its epidemic proportions after the army had returned. In spite of that, however, once the disease had been contracted it still lingered on in milder form thenceforth in many individuals; in these individuals it was thenceforth plainly visible, at least when they evinced an unusual predisposition to watering. I became convinced of the above in the military hospitals established during the campaigns of 1813 to 1815

(255) See Larrey, l. c., volume 1, pages 202, 209, 219.
See Assalini, l. c., pages 108, 110-111.

(256) See Assalini, l. c., pages 121-122.

(257) See the letter of Larrey in the Journal der Chirurgie und Augen-Heilkunde, volume 1, pages 177-180, number 1, 1820.

for several thousand wounded and sick French war prisoners in Berlin, Torgau, and other places on my list for inspection at the time. Adams, too, saw conspicuous instances of this when he visited several large hospitals in Paris on his last trip [in 1814] (258).

Chapter III.

History of logado-blennorrhea among the British troops from 1801 to 1818, caused by the Egyptian campaign.

Article 115.

The British army under the command of Lieutenant-General Abercromby, which landed at Aboukir in 1801 (259), soon numbered many cases of trachoma. The wide spread of the epidemic among this military force in Egypt is at once evident from the fact that several quite large military hospitals for eye patients alone had to be set up, and that not one member of the crew of any of the ships lying at anchor escaped trachoma (260). Available reports on the symptoms of this disease (reports occasioned by that expedition) have been discussed in detail earlier in this book (261); therefore I shall add only the following remarks. It cannot be denied that the English physicians were the first to point out: that the Egyptian ophthalmia produces wholly distinctive structural changes in the conjunctiva; and that, during the early period of the disease, the palpebral conjunctiva in particular looks much like the valvulae conniventes of the small intestine when injected with vermilion, as regards color and granular structure. The illustration of a fungous ectropion annexed to the book of Vetch is particularly instructive as regards the further development of this structural anomaly (262). Although this engraving is not executed with skill, it very clearly expresses the characteristic picture, that is, the granulations which are seen everywhere and which present countless points of excretion (263). So that any reader [who so desires] may compare Vetch's copperplate engraving with my drawings, I had it faithfully copied (after suitable alteration of the surrounding parts, overly neglected in the original); it appears as the second figure of table four (264).

(258) See the letter of Sir William Adams in the Journal der Chirurgie und Augenheilkunde, volume 1, pages 170-176, number 1, 1820.

(259) See Wedekind, l. c., page 288.

(260) See Farrel and Brigges, quoted by Omodei, l. c., pages 17, 32, 33, 52, 87.
See Macgregor, quoted on page 7 of the German translation of the English text of Vetch.
See the German translation of the English text of Vetch, l. c., pages 44, 77.
See the book by Larrey, l. c., volume 1, page 217.

(261) See Article 110.

(262) See the German translation of the English text of Vetch, l. c., pages 18-44.
See Ware, l. c., page 3 of Appendix.
See Günther, l. c., page 46.

(263) See the English text of Vetch, l. c., engraving number 1 at the end of book.

(264) See Article 308.

Article 116.

The ensuing evacuation of Egypt in 1803 (265), after which the British army was broken up and sent to points of duty which varied widely, gave rise to the most extensive propagation of trachoma. Wherever those troops were concerned indirectly or directly - in Malta, Sicily, Gibraltar, Portugal, and Spain -, the disease made its appearance; sometimes it was more severe and sometimes it was less severe. It broke out in Great Britain worse than anywhere else, in accordance with the above. Here logado-blennorrhea was first noticeable among the troops of Irish regiments; from these it was introduced into England in the year 1804, being communicated to the second battalion of the 52nd regiment, and the latter infected almost all divisions of the army with it. One can tell how many individuals contracted trachoma by one instance, the statement [of Macgregor, l. c., page 49] that "in the second battalion of the 52nd regiment, which consisted of somewhat more than seven hundred men, six hundred and thirty-six cases of ophthalmia were admitted into the hospital between August 1805, when the disease commenced, and August 1806". The highly destructive nature of the disease is attested by the fact that the number of blinded soldiers rapidly rose to five thousand, and that the government allowed about one hundred thousand pounds sterling a year for the support of those unfortunate men. -

With so much propagation of the disease among the army, its communication to the general masses was bound to occur soon. At the beginning the epidemic appeared in the houses of prostitution most requented by soldiers; later on it appeared throughout the land, but it was most virulent in public institutions crowded with human beings (particularly in schools, orphan asylums, and hospitals). Macgregor [l. c., pages 49-50] tells us: "And it is a melancholy fact, as appears by the returns of Chelsea and Kilmainham hospitals, that 2317 soldiers were, on the first of December 1810, a burthen upon the public, from blindness in consequence of ophthalmia". The Royal Military Asylum (established for the education of fourteen hundred children connected with the army) had had fifteen hundred cases [including recurrences, and counting the adult staff] of the Egyptian ophthalmia [from 1804] up to 1811. Between six and eight hundred of the children admitted to Christ Hospital came down with trachoma almost simultaneously during the year 1815. In addition, according to a personal communication from Sir William Adams, in 1818 the disease affected one hundred and fifty adults simultaneously in a public workhouse. From all the foregoing we perceive that, up to that time, trachoma in England had steadily remained at the high pitch attained soon after the return of the army from Egypt (266).

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(265) See Wedekind, l. c., page 328.

(266) See Macgregor, l. c., pages 49-50.
See the German translation of the English text of Vetch, l. c., pages 1-17, 19-45, 60-61.
See the letter of Sir William Adams in the Journal der Chirurgie und Augen-Heilkunde, volume 1, pages 170-176, number 1, 1820.
See Ware, l. c., pages 9-19 of Appendix.
See Günther, l. c., pages 39-47.
See Omodei, l. c., pages 17, 50, 53, 88, 92, 145.
See Ziermann, l. c., page 203.

Chapter IV.

History of logado-blennorrhea introduced into Italy from Egypt between 1801 and 1813.

Article 117.

The epidemic which supervened in Italy was identical with the disease observed in Egypt as well as in England (267). Among its essential symptoms the Italian physicians number itching of the eyelids, changes in the palpebral conjunctiva making it look like velvet, photophobia, purulent discharges which are unusually copious and sometimes corrosive, severe frontal pains, monstrous swelling of the lids, and in the advanced stages of the disease acute attacks of fever often accompanied by delirium (268). In Italy, too, the disease had no fixed duration. Omodei gives it as fourteen to twenty days, but more often saw the eyeball burst within as short a time as twenty-four to thirty hours (269).

Just as in the English army and French army in Egypt, here the sequelae took the form of a very marked tendency to suffer recurrences, frequent corneal opacities, various ulcers, staphyloma, prolapse of the iris, cataract, and not seldom complete destruction of the entire eyeball (270).

As regards the causes most instrumental in the spread of the disease, the following is to be noted. The recently arrived conscripts were the men who were most susceptible to trachoma. Furthermore, it occurred primarily among the foot soldiers; for instance, while the sixth Royal Italian Infantry Regiment numbered one hundred and fifty-eight eye patients, Napoleon's Dragoons sent but one case of trachoma to the hospital. Those divisions of troops which had survived earlier attacks of trachoma were unusually apt to suffer recurrences after strenuous exertions. Thus the Royal Italian Grenadier Guards, in whom the disease was thought to have already run its course at Mantua, suffered severely from trachoma two years later, when they reached Hungary. The same experience likewise befell those companies in which apparent recovery at Vicenza was followed by a recurrence when they reached Palmanova. The epidemic gained momentum wherever regiments were in barracks or stationed along the coast; this was the case particularly in the marches, billeting, and garrisoning of the abovementioned sixth regiment at Elba, Mantua, and Ancona. The intercourse between the soldiers and townspeople, from billeting as well as from the return of individual soldiers to the bosom of their families, was indeed everywhere responsible for communicating the disease from the army to the general public, but the disease always raged most among the inhabitants of maritime cities (271).

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(267) See Articles 110-114.

(268) See the letter by Scarpa in Nuovi Commentari di medicina, Padua, volume 1, semest. I, pages 204-211, number 5, March 1, 1818. (Especially 205-206).
See the book by Scarpa. "Trattato delle principali malattie degli occhi", l. c., volume 1, pages 4-5.
See Bongiovanni and Marescotti, quoted by Omodei, l. c., page 4.
See Penada, quoted by Omodei, l. c., page 36.
See Omodei, l. c., pages 9, 109-110, 113, 115, 117.
See Vasani, l. c., pages 17-21.

(269) See Omodei, l. c., pages 111 and 114.
See Vasani, l. c., page 19.

(270) See Bongiovanni and Marescotti, quoted by Omodei, l. c., page 5.
See Omodei, l. c., pages 99, 116-117, 158.

Article 118.

The magnitude of the outbreak of logado-blennorrhea is evident from the following circumstances. Out of just one regiment at Ancona, one hundred and fifty-eight men were transferred to hospitals within the space of twenty days. In addition, the local station for eye patients almost constantly contained two hundred and twenty patients with trachoma. In the year 1812 the hospitals of that city were obliged to admit fully fifteen hundred eye patients. This anomaly was so malignant that, out of fifteen hundred trachoma patients, one hundred and forty-six were wholly or almost wholly deprived of sight. We gain some idea of its highly contagious nature from the following. Scarpa, who had had wide experience, considers that the epidemic can be checked only by those means which are indicated for the plague itself. The War Department employed two hundred thousand lire just to carry out these most necessary precautions (272).

Article 119.

The disease had two starting points. Shortly after the appearance of the French troops (who had belonged to the Egyptian expedition) in the year 1801 at the island of Elba in part, and at Leghorn in part, trachoma broke out plainly among the Italian soldiers in both places (273). It next spread from both landing places along the coast of the Mediterranean Sea to Chiavari and Genoa (274); from 1804 to 1810 it spread to cities farther inland, to Parma, Mantua, Padua, Vicenza, Cremona, Lodi, and Milan (275). This epidemic did not cross to the opposite seaboard, the coast of the Adriatic Sea, until the sixth Italian regiment (which had been infected in Elba, and which had had no surcease from trachoma for seven years) returned from the Spanish campaign. That is, not many weeks after the abovementioned division of troops had reached Ancona, this eye disease (freely communicated to prostitutes) was seen in some of the townsfolk as well. Once it had been transplanted to the city, it soon grew beyond control both in intensity and extent until, in the year 1812, having attained the highest malignancy, it spread out from Ancona along the seaports (Senigallia, Rimini) and later inland as well (across Loreto and Macerata) as far as Ascoli. During this period when the epidemic obviously reached its peak, it was perceived that the disease most generally proceeded from the soldiers to the community. But this very communication of trachoma to many individuals

(271) See Mongiardini, quoted by Omodei, l. c., pages 35 and 55.
See Omodei, l. c., pages 1, 4, 57-58, 61, 82, or 88, 92-93, 96-97.
See Vasani, l. c., pages 35 and 37.

(272) See Rima, quoted by Omodei, l. c., page 101.
See Vasani, l. c., pages 40 and 52.
See Omodei, l. c., pages 12, 45.
See the letter by Scarpa in Nuovi Commentari di medicina, Padua, volume 1, semest. I, pages 204-211, number 5, March 1, 1818. (Especially 205).

(273) See Omodei, l. c., pages 7, 9, 38, 57.
See Mongiardini, quoted by Omodei, l. c., pages 35 and 55.
See Vasani, l. c., page 33.

(274) See Mongiardini, quoted by Omodei, l. c., pages 35-55.

(275) See Penada, quoted by Omodei, l. c., pages 36-37.
See Colla, quoted by Omodei, l. c., page 38.
See Cimba, quoted by Omodei, l. c., page 60.
See Vasani, l. c., pages 35 and 38.

totally lacking in predisposition was also largely responsible for the much desired end of the devastating disease (whose first traces had been seen as early as 1801) in Italy in 1813. From this time on trachoma continued only among those divisions of the army which, having joined Napoleon's main army for the Russian campaign, were exposed to renewed hardships (276).

Chapter V.

History of ocular blennorrhea among the troops of the Allies (in Germany, France, Holland, Belgium, Sweden, and Norway) from 1813 to 1815, caused by the War of Liberation.

Article 120.

If all the essentail symptoms attending the appearance of the eye disease among the armied to the Allies (277) are compared with the characteristic symptoms of the disease conveyed directly from Egypt to France, England, and Italy (278), the following is noted. Everywhere the symptoms present were: loss of cohesion of the palpebral conjunctiva, even reaching the formation of papillae; anomalies of secretion ranging from watering to the discharge of pus; anaomalies of sensation ranging from itching of the eyelids to the most frightful frontal pains; in the milder stages, absence of fever; in the more advanced stages, obvious participation of the whole vascular system; a remittent type; no fixed duration; a marked tendency toward recurrences; the same contagious spread; the same sequelae, rapidly destructive or long drawn out (279). Consequently there is not the least doubt that this epidemic is identical with the older ones.

Article 121.

Various forms (280) were assumed by the disease during the War of Liberation in Germany, France, Belgium, and Holland; it was seldom synochal, more often torpid, and most often erethistic. The form of vegetation at that time varied chiefly with the individual constitutions; the latter, generally speaking, were a matter of nationality and of the difference in [social] rank. The initial form of trachoma among the Russians, Swedes, and British was synochal as a rule, but torpor soon took its place. Erethistic blennorrhea afflicted most of the French and Italians. The form varied more among the Germans than among all the other races: stubborn erethism was usually the fate of sons of wealthy parents, youths from the educated upper classes; but individuals who sprang from the lower classes, having more brawn than brains, almost always suffered from logado-blennorrhea which was synochal at first and turned into genuine torpor later on.

Article 122.

The severity of the outbreak of trachoma was not everywhere alike. In some regiments a great many individuals were afflicted, in many only a few contracted trachoma, and other regiments escaped it entirely. But, on the whole, how few

(276) See Bongiovanni and Marescotti, quoted by Omodei, l. c., page 4.
See Omodei, l. c., pages 1, 2, 7, 54, 57, 63, 88, 94.
See Vasani, l. c., pages 28, 35, 39.
(277) See Articles 1-52.
(278) See Articles 112-119.
(279) See Articles 1-52, 63-73, 106-119.
(280) See Articles 75-78.

troops escaped trachoma altogether is shown by the fact that almost all sections of the army sent trachoma patients to the military hospitals. It is utterly impossible to tell exactly how many trachoma patients were treated in the region formerly under my inspection, for several reasons. Sick lists were not kept in all the regiments of the different nations. So far as army medical inspection was concerned, several provinces were not under my jurisdiciton right from the beginning of the war. When I did take over many of them, the preceding boards of health (which had been active for months) could not specify all military hospitals under their jurisdiction, let alone the figures for every single institute, or even the number of patients admitted.

However, the average wide extent of this epidemic can be judged simply from the large number of those trachoma patients of whom accurate lists were kept by several military hospitals and regiments. Thus, for instance, there were twenty, sixty, one hundred, and even two hundred trachoma patients in the hospitals at Berlin, Stettin, Torgau, Dresden, Münster, Mainz, Coblenz, Cologne, Aix-la-Chapelle, Liége, and Namur. Some of them had been sent directly from the army; some had been transported from the hospitals of Maubeuge, Saint Quentin, Versailles, and Paris to the nearest institutions. Thus, during the siege of Torgau the first Landwehr Infantry Regiment of East Prussia numbered over two hundred eye patients, during the cantonment at Meissen the Infantry Regiment of Kolberg numbered about two hundred and fifty eye patients, up to the battle of Leipzig the first Infantry Regiment of East Prussia (which had marched out with the Army Corps of General York from Konigsberg) numbered seven hundred eye patients, and between the autumn of 1813 and the autumn of 1814 the Kurmark [Brandenburg] Landwehr Infantry Regiment numbered about fifteen hundred eye patients. If one were to estimate the total number of eye patients on the basis of the abovementioned statistical records backed by proof, a reasonable guess would be that in the allied armies, counting the whole duration of both campaigns, at least twenty to thirty thousand soldiers were afflicted with logadoblennorrhea.

Article 123.

Before we pass on to the chronologic order of the individual appearances of the epidemic, I shall now briefly repeat (in order to facilitate the outlining of the facts) what I said in the earlier part of my book (281). In every respect trachoma obeyed those laws which govern epidemics in general. In other words, at the outset the cases seen were but few and mild; during this period the disease took the form of watering and was easily cured, for the most part. Later on the anomaly was commoner and, when the discharge of mucus set in, appreciably more stubborn. Shortly afterward the disease reached its peak of intensity and extent, when it affected a large number of persons and developed into its most virulent form, the discharge of pus. During the fastigium the disease abated for a time, but fresh exacerbations occurred as soon as external circumstances were propitious thereto. Subsequent to the fastigium trachoma subsided increasingly; thereafter it regressed to the stage of discharge of mucus first and to the stage of watering next, until finally it became extinct almost everywhere (282).

Article 124.
Beginning of the epidemic in the year 1813.

Early in 1813, when Napoleon's plan for world supremacy in the north was frustrated, when the Prussian Army Corps (which at an earlier date had formed a contri-

(281) See Article 72.
(282) See Articles 124-126.

bution to the troops of Macdonald, marshal of France) commanded by General York proceeded from the confines of Russia across Königsberg to Berlin, this corps brought the first trachoma patients with it. Although even at this time the number of patients with logado-blennorrhea in individual corps (283) was not altogether insignificant, the anomaly was not as yet very intense. At this time, for the most part, trachoma was cured while merely in the stage of watering, so that the victims did not even have to leave their regiments. Therefore, up to the end of April, but few cases of pure ocular blennorrhea were sent to the military hospitals erected between the Oder and the Elbe.

In May Napoleon crossed the Saale [river] with newly recruited active forces, and his divisions of the army advanced swiftly and threatened battle close to Prussia's capital. At that time I received orders from General Lestocq to transport back across the Oder three thousand patients (some Prussian, some Russian) who formed groups in Berlin, Potsdam, and Brandenburg. At our departure most of the soldiers were either simply wounded of down with typhus, with but few cases of watering. Since only a few hundred sick could be removed in wagons, the majority of those patients were provided with everything necessary and sent forward on boats plying upon the Spree [river] through the Finow canal to Güstebuse (a village lying not far from Zehden on the Oder). From there I distributed them in separate larger and smaller cities. A great change was noticed in the patients when they landed at Güstebuse: I found that several slightly wounded men had recovered, that the cases of more severe wounds were no worse, that practically all the typhus patients (among whom the mortality during the crossing had fallen far below the earlier figure in the military hospitals) showed improvement, and that in most of the latter the dangerous nervous fever had given way to an intermittent fever (easy to cure and tertian). Accordingly, the trip by water did more good than harm in general, but patients with watering of the eyes did not benefit by it; every single one of the latter not only failed to improve but even felt worse. Shortly after unloading the patients, the eye disease again diminished appreciably. It abated particularly among the victims sent inland to the military hospitals of Mohrin, Soldin, Pyritz, Stargard, and Naugard. Only in patients who entered hospitals exposed to sea air (as at Wollin and Cammin) did I observe that the disease offered stubborn resistance, and that it afflicted individuals who had had no previous eye trouble.

During the first few days of June, the overflow hospital organized at Zehden (designed for subsequent patients transferred) received a much larger number of patients with watering than before, though the total was not very large. Most of them came to me from the columns of General York and General Barclay de Tolly, which in May had defeated the French and Italian corps commanded by marshal Ney at Königswartha.

The rest enjoyed by soldiers after a truce was concluded in July was responsible for the marked general decline in the number of patients at that time. This was particularly true of patients suffering from watering, thanks to the simultaneous appearance of fair and clearer weather.

In August, when the campaign was resumed, the bloody combats of Grossbeeren and Dresden were a severe strain on the army; accordingly there were again more eye patients in the military hospitals. Later on, in October, nearly half a million soldiers joined forces for the battle of the nations at Leipzig; shortly afterward the damp and cool autumn set in, with sudden changes in temperature, and the number of trachoma patients mounted even higher. Around this time I saw most cases of watering in the fourth Army Corps, commanded by General Tauentzien von Wittenberg. Particularly affected were many individuals of those regiments stationed before

(283) See Article 122.

Torgau, which were forced to bivouac for a long time upon the swampy meadows in part and close to the banks of the Elbe in part. As regards the influence of locality on trachoma, it is also noteworthy that even later, even after the surrender of the fortresses, ocular blennorrhea continued in all cities on the Elbe and on the Oder, where by comparison it was the most stubborn.

Article 125.
Increase of the epidemic in the year 1814.

Napoleon's army constantly retreated farther; the victorious troops of the Allies crossed the Rhine; from the battle of Brienne-le-Château (at the end of January) up to the capture of Paris (in March) conflicts (some smaller, some larger) took place upon the banks of the Aisne, Marne, Aube, and Seine rivers almost incessantly; the hard won peace was the occasion for swift homeward marches in the summer heat, which could not be executed without various hardships. During the above events trachoma in part attained a noticeably higher stage of development, since everywhere it advanced at least to the stage of discharge of mucus. In part it became so extensive that it invaded not only all the hospitals of Germany (284), France (285), and Belgium (286) erected closer to the armies; when the Swedish forces returned home, the epidemic even spread to the far north, which was not very susceptible to contagions. How extensively logado-blennorrhea raged in colder regions within the period mentioned is shown by the various outbreaks of the epidemic, in the garrison hospital at Stockholm, among the crews of many Swedish warships, and among the entire Swedish Reserve Army, previously free from eye patients (287).

Article 126.
Peak and decrease of the epidemic in the year 1815.

Thanks to more rest readily granted the soldiers when the hard won peace came at the beginning of the year 1815, the epidemic certainly abated to some degree. But it by no means died out at this time, as shown by the very fate of the sixteenth Prussian Infantry Regiment, which sent one hundred and twenty more trachoma patients from Dresden to Berlin in the spring of the same year. Furthermore, that decrease in the epidemic did not last long; the epidemic soon raged again, after Napoleon's return from Elba necessitated a second campaign, and all the vast armies of the Allies swiftly rallied again to advance on France. Right during the march thither the disease increased considerably; at any rate, during the march the troops had left behind many comrades in the stage of discharge of pus at Münster, Mainz, Coblenz, Cologne, Düsseldorf, Wesel, Aix-la-Chapelle, Liége, Namur, and Maestricht; when I inspected the military hospitals I found that most of these patients were severely afflicted. I had an unusually large number of victims suffering from the worst form of blennorrhea brought together in hospitals of Belgium and the Rhine provinces when the Prussian and British forces were drawing closer together, when

(284) See Article 122.
(285) See Article 122.
(286) See Kluyskens, l. c., pages 35 et seq. or Article 122.
(287) See Gadelius, l. c., page 132.
See Faxe, l. c., page 134.
See Rudolphi, l. c., page 135.
See Kewenster, l. c., page 133.

in June of 1815 the armies of the Allies defeated Napoleon at Belle Alliance, when the Allies unremittingly pursued the remainder of the enemy columns up to the second capture of Paris, up to July seventh.

In the summer and autumn of the year 1815 the epidemic unquestionably reached its acme. At this period the disease very often flourished in its most virulent form, and not only was it most widespread among the troops but also it was now plainly communicated to the general masses in many places. Kranz, a Prussian regimental surgeon, saw the disease develop among the rural population in the vicinity of Trier after the billeting of troops numbering cases of trachoma. Professors Reyland and Naegele observed the outbreak of trachoma from a like cause in several families at Düsseldorf (288). Kluyskens affirms that the country residents of Holland contracted trachoma from the infected Dutch soldiers who returned home (289). The aulic councillor Munstermann noticed at Munster that often the entire household became infected where eye patients were quartered in private homes, and that this was particularly true in neighborly country towns among peasant families who treated the soldier like one of the family (290).

The high pitch, however, led to the decline; the communication of the disease to many individuals having no predisposition produced hybrid forms and thus destroyed the virulence of the contagion (291). Both the peace achieved and the largely dry winter which had set in prevented fresh recurrences of the disease. Therefore even toward the end of the year 1815 the number of trachoma patients showed a marked falling off. From this time on the disease showed constant and increasing regression to its lower stage and its epidemic form became almost wholly extinct in the clear summer of the year 1816, according to the ophthalmologic reports which I received even after I had left the army (292). Only in a few places where large groups of patients had stayed for a fairly long time were mild traces of the disease still to be seen. Such traces, however, were sufficient to be able to cause fresh outbreaks of the epidemic sooner or later when conditions were propitious, according to my earlier discussion of this subject (293).

Chapter VI.

Conclusions.

Article 127.

My earlier account (294) leaves no doubt that epidemic contagious logadoblennorrhea was observed in warmer climes even before the time of Christ. Furthermore, the eloquent evidence submitted in Article 131, to the effect that certain

(288) See the report of the director of the military hospital of Düsseldorf, dated August 18, 1815.

(289) See Kluyskens, l. c., pages 37-38.

(290) See the report of the director of the military hospital at Münster, dated September 20, 1815.

(291) See Article 72.

(292) When the war was over, in requesting to be relieved from my military duties, I made one exception: I asked to be informed of later developments in the case of eye patients. In this connection I am indebted to the zeal of Doctor Zitterland for sending me reports of solid merit. See my remarks in the Foreword.

(293) See Article 72.

(294) See Article 106.

local conditions are conducive to the disease, shows that there were epidemics of trachoma in Europe even centuries ago. Consequently this anomaly is by no means to be regarded (as many would have it) as a development of recent years, as the natural outcome of racial impurity, as a disease never seen before.

Regardless of both when and where trachoma has occurred, throughout its history it has presented the same essential symptoms at all times and in all places. The quality and quantity of the secretion, the structural anomaly of the conjunctiva, the danger of losing the eye through bursting, et cetera were described by the patriarchs of Greek and Arabic medicine no less than by the younger disciples of Aesculapius. The very same manifestations were seen by physicians who are alive today, in the delta [of the Nile] just as upon the banks of the Thames, the Arno, and the Rhine (295).

Article 128.

We have proof positive that the contagious principle of logado-blennorrhea which has reached its fastigium is transmitted from race to race. Napoleon's army was attacked by the virus in Egypt, suffered heavily from it, and brought it back from there to France and Italy. The British fleet carried the miasma back to England from the banks of the Nile. In Prussia, Saxony, and Belgium the military forces of the Allies encountered French, Italian, and English troops which were by no means entirely free from trachoma. Because of that mingling they became susceptible to the disease and in this way suffered from the epidemic which devastated Germany, Belgium, Holland, Sweden, and Norway during the years 1813 to 1815 (296).

Article 129.

History teaches us that, down through the ages, sudden changes of locality on the part of large groups of people herded together - entailing physical exertion and unwonted privations - have been very largely responsible for the epidemic development of ocular blennorrhea. Xenophon's soldiers suffered sorely from their eyes during the retreat across the Euphrates. Napoleon's troops were a prey to exacerbations of logado-blennorrhea in Egypt whenever they were subjected to additional physical strain and to overcrowding. The highest number of eye patients was found among the military forces of the Allies after the battle of Leipzig and after the battle of Belle Alliance, where there was an encounter of hastily assembled armies of colossal size (297).

Article 130.

Warm and damp weather characterized by sudden changes in temperature has always been conducive to the development of trachoma. Hippocrates remarked long ago that ocular blennorrhea is present in epidemic form in the spring and autumn, for the most part. In Egypt, Prospero Alpini saw a regular return of the epidemic in the spring and in the autumn. There were very severe outbreaks of trachoma among the troops of the Desaix division, which was constantly embarked upon the Nile and thus was most exposed to burning heat by day, and to dampness and cold by night. There was a marked increase in the number of trachoma cases among the three thousand wounded and sick who, in May of 1813, were transported back across the Oder on ordinary ferryboats plying upon the Spree through the Finow canal; such cases arose from the damp air as well as from the cool of the evening. The epidemic which attacked the army of

(295) See Articles 106-126
(296) See Articles 111-114, 116, 119, 124-126.
(297) See Articles 106, 113, 124-126.

the Allies began in the spring of 1813; its first exacerbation occurred during the damp and cool days of October of the same year, and its peak was reached in the autumn of the year 1815. The mild winters and the rainy summers of the year 1813 to 1815 were conducive to its development; the dry and cold winter of the 1815 to 1816 season and the fair and clear summer of 1816, on the contrary, were very largely instrumental in wiping out the disease (298).

Article 131.

Logado-blennorrhea is strongly influenced by the nature of the locality. -

It is plain that the disease was very apt to flourish in all regions very close to the seashore or to the banks of larger streams, and in all regions damp and marshy or in general saturated with vitiated air. This applies just as much to individual communities as to whole sections of a country. Thus the disease proved to be highly malignant in the cities built in the immediate vicinity of the Nile; Rosetta, Cairo, Giza, and Damietta. That is why its advance was swift upon the banks of the Thames at London and Reading in part, and upon the Straits of Dover at Dover and Hythe in part. In the same way it attained conspicuous virulence: upon the shores of the Mediterranean Sea at Genoa, Chiavari, Leghorn, and Porto Longone [Elba]; and upon the shores of the Adriatic Sea at Senigallia and Ancona. Thus (299) it began in the cities upon the Baltic Sea at Cammin and Wollin; it raged continuously along the Oder (at Stettin and Zehden), along the Elbe (at Magdeburg, Barby, Wittenberg, Torgau, and Dresden), along the Rhine (at Wesel, Düsseldorf, Cologne, Coblenz, and Mainz), and along the Meuse (at Maestricht, Liége, and Namur).

The following facts show how not only in single spots and cities, but also in extensive districts and even larger countries, there can abide properties which are more or less favorable to the growth of logado-blennorrhea.

Within the delta, in the very fertile but also the lowest part of Egypt (through which the Nile runs, forming a network, as it were), the disease has prevailed since early times (300).

The inhabitants of sea-girt England were a prey to ophthalmia long ago; here this disease was found long before the return of the soldiers from Egypt, and though not severe it was quite frequently widespread; here the miasma just brought back from the east rendered the disease most virulent; here it remained in the advanced stages most stubbornly from that time on (301).

In the European delta - in fenny Holland, many parts of which are at sea level, protected against floods solely by dikes and canals - logado-blennorrhea was always common, and as early as 1565 was actively contagious and epidemic (302). There, because of that propagation of the miasma which campaigns in modern times occasioned, the disease reached advanced stages for several years, just as it did in England.

Italy's fair provinces, not uniformly healthy, had also long been the cradle of epidemic eye diseases, owing to a wide variety of atmospheric conditions. Immedi-

(298) See Articles 106, 110, 113, 124, 126.
(299) See Articles 111, 116, 119, 124, 126.
See the German translation of the French text of Frank, l. c., page 63.
(300) See Articles 71, 111, 119.
(301) See Article 116.
See Ware, l. c., page 2 of Appendix.
(302) See Article 125.
See Forestus, l. c., Lib. V, page 31.

ately after the notable earthquake which caused severe tremors in Rome in 1703, apart from polymorphous outbreaks of herpes and scabies there appeared malignant eye diseases, characterized by hot discharges which were salty and acrid; these diseases owing to steady rains and cool weather, were spread far and wide (303). Somewhat later, in the year 1712, in the low-lying and unhealthy situation of Ferrara, there was seen epidemic trachoma which swiftly attacked not only the inhabitants but also strangers; the attacks were such that not a single person who merely passed the night in the city escaped the disease on the following day (304). As long ago as 1788 Penada observed widespread epidemic contagious logado-blennorrhea in Italy (305). But unquestionably the most dangerous and stubborn forms of trachoma in Italy were those produced by the virus of infection introduced from Egypt between 1801 and 1815 (306).

In Germany, where the injurious properties mentioned in this article are for the most part lacking, the disease never lasted very long, although trachoma had repeatedly appeared in Germany even in earlier times. From 1699 to 1701 trachoma prevailed generally and was destructive in the extreme at Breslau; but from this time on no traces of its malignancy remained (307). During 1761 and 1762 many soldiers of the combined German and English armies in Westphalia were seized with exceedingly severe ophthalmias (308). In the year 1777 a similar epidemic developed at Vienna (309). Owing to a combination of favorable circumstances, the military events of the years 1813 to 1815 disseminated trachoma almost throughout Germany, yet here the disease died out far more completely than in Great Britain, Italy, and Holland (310).

Article 132.

If we sum up all facts established in the foregoing, the net result is as follows. It is true that logado-blennorrhea has prevailed in both epidemic form and contagious form down through the ages, not only in the orient but also in our part of the world. Nevertheless, all such epidemics present in times past in Europe were of less extent and less intensity than those epidemics which supervened in England, Italy, Holland, Germany, Sweden, and Norway at the conclusion of the Egyptian campaign.

Moreover, decades must pass before we can settle whether the prevalence of the disease (which very recently was furthered in our latitude by concentration of large armies) is connected with two things. I refer not only to the spreading of the miasma derived from the Nile but also to the change in the climate. The latter is evidenced by the notable melting of the immense icebergs at the North Pole, by the almost complete extinction of the Northern Lights, and by the return of the magnetic needle from its deflection to the west.

(303) See Baglivi, l. c., pages 523 and 568.
(304) See Omodei, l. c., pages 70-71.
(305) See Penada in Nuovi Commentari di medicina, Padua, volume 6, semestr. 2, 1820.
(306) See Article 118.
(307) See "Historia morborum qui annis mdcic, mdcc, mdcci, Vratislaviae grassati sunt", l. c., pages 15, 67, 271.
(308) See the German translation of the French translation of the English text of Monro, l. c., volume 2, page 55.
(309) See Stoll, l. c., Th. 2, pages 123-130 et seq.
(310) See Articles 124-126.

Book four. Etiology.

Chapter I. General consideration of the causes of trachoma.

Article 133.

Before the full significance of trachoma was grasped, opinions as to its etiology were necessarily erroneous in many respects. From remotest times physicians have striven to find some particular cause to which alone the origin of the disease might be ascribed. The sole cause responsible for the disease has been claimed by many to be the very delicate bristles of the cactus plant disseminated in the air. Some have supposed it to be the Filaria papillosa. Many have blamed it on fine nitrous or lime dust lodged in the eyes. Several have given it as atmosphere surcharged with muriatic vapors; as catarrhal, typhous, psoriatic, scrofulous metases; as concealed gonorrheal or syphilitic infections. Still others have attributed it to a virus sui generis. However, since the assumptions of one observer based on isolated occurrences were regarded with scepticism by his opponent on the basis of equally valid observations, and since authors thus contradicted one another (sometimes with more reason and sometimes with less), all the above views found little credence (311). If we wish to sift the accumulation of contradictory evidence and find out the truth about the etiology, we must above all eschew the paths taken so far. We shall learn the truth only after accurate determination of the nature of the anomaly (312), after a more searching enquiry into the history of the disease (313). Then we must carefully weigh the causes responsible for the disease in the past and at present, in our own latitude as well as in the most distant zones.

(311) See Articles 63-73.
See the book by Larrey, 1. c., volume 1, pages 203 et seq.
See Assalini, 1. c., pages 105 et seq.
See Chamseru, 1. c.
See Olivier, 1. c., volume 2, page 142.
See the German translation of the French text of Volney, 1. c., volume 1, page 189.
See Mongiardini, quoted by Omodei, 1. c., page 35.
See Edmonstone, Brigges, and Royston, quoted by Omodei, 1. c., page 32.
See Omodei, 1. c., page 42.
See Vasani, 1. c., pages 39 and 52.
See the German translation of the English text of Vetch, 1. c., pages 4-18.
See the German translation of the French text of Frank, 1. c., page 56.
See Günther, 1. c., pages 42 and 47.
See Atkinson, 1. c., page 118.
See Baltz, 1. c., page 25.
See Kluyskens, 1. c., pages 1-43.
See Fischer's thesis, 1. c., page 17.
See Lehmann, 1. c., pages 10-18.
See Ziermann, 1. c., page 205.
See Helling, 1. c., pages 24 et seq.
See Kutchkovsky, 1. c., pages 231 et seq.

(312) See Articles 1-105.

(313) See Articles 106-132.

Article 134.

The proximate cause of trachoma is completely bound up with the nature of the disease. All data that may at present be put forward to explain this causal relationship are therefore contained in my section on nosology, where I discussed the nature of logado-blennorrhea (314).

The remote causes are many. To give a detailed list of all sufficiently well known toxic factors which produce trachoma in just certain persons would be entirely out of place in this book. Our concern here is purely with the causative factors which give rise to the general spread of the disease. For ready reference, I shall now discuss these causes in order, first the ones that pave the way, and then the occasional causes.

Chapter II. Causes that pave the way.

Article 135.

The causes that pave the way are, per se, for the most part insufficient to produce trachoma. Usually they increase merely the tendency of the conjunctiva toward secretions in general, and toward blennorrheal discharges in particular. Nevertheless, the stronger their action, the more readily does the disease likewise break out as the result of the occasional causes. All such causae disponentes fall into two main groups: namely, many of them act on the conjunctiva directly and for the most part locally, while others act on it indirectly through systemic disease.

a) Causae disponentes whose action on the conjunctiva is rather local.

Article 136.

aa) Glare of all kinds acts first on the deeper or sensory part of the eye alone; the resulting increased activity is immediately reflected by it to the outer covering of the eye, to the conjunctiva. This relationship is at once evident from the fact that, after every strong impression of light, the conjunctiva appears intensely red and subject to excessive secretion. If such irritations are repeated fairly often, as the capacity of the eye for secretion increases they increase the tendency of the eye toward blennorrhea as well. Whenever I had occasion to examine soldiers who had watched through dark nights around the brightly burning campfire, I found that in the morning their eyes were reddened, sensitive, and unusually moist from the serum streaming forth. On my questioning many trachoma patients in the military hospitals, they explained that their eyesight first became affected in two ways: from constantly looking at the brilliant limestone plains, and from the dazzling chalk-white roads of France. When Xenophon led his army for days at a time over the glittering snowy surfaces of the highest Armenian mountains, many of the men suffered from severe eye complaints (315). Trachoma increased considerably among the French army because the outlook of the soldiers was the white limitless expanse of the desert sands of Syria (316).

Article 137.

bb) Since congestions toward the head essentially promote the act of secretion in the conjunctiva (317), all influences responsible for copious flows of blood of this kind appear to be at the same time indirect causae disponentes of logado-blennorrhea. In this connection I shall make special mention of the following circumstances.-

(314) See Article 56.
(315) See Xenophon, 1. c., Lib. IV, Cap. 5, Articles 12-14.
(316) See Article 111.
(317) See Article 83.

Certain items of the military uniform of our time (particularly the regulation head coverings, the snugly fitting uniform collars, and the overly narrow waistbands) are highly conducive to congestions toward the head (318). I have often been assured by eye patients that their clothing was certainly responsible in part for their trachoma. In addition, several physicians in charge of major military hospitals regarded this as one of the main causes of logado-blennorrhea (319).-

Moreover, the swift moves of armies necessitated by modern military tactics in general cause congestions, and the latter are certainly all the more severe as during marches the soldier is heavily burdened by cartridges, gun, knapsack, cloak, canteen, food, et cetera (320). All infantry regiments of East Prussia which bore arms on practically uninterrupted forced marches from the confines of Russia across Königsberg to Paris, and back home again, fell ill primarily for that reason. That is why the epidemic grew worse after the hasty assembling of troops which took place for the battle of Leipzig, and for the battle of Belle Alliance (321). For the same reason the number of trachoma patients likewise increased in the French army during the Egyptian expedition after every forced march (322).-

Lastly, indulgence in spirituous liquors likewise appreciably increases the activity of all blood vessels belonging to the brain and eye, and in this way promotes trachoma no less than do the other causes mentioned so far. Soldiers who regularly consumed a large amount of brandy every day were particularly susceptible to trachoma. Similarly, many of those individuals who were unaccustomed to wine soon contracted trachoma in France when they selected wine for their sole beverage. The experiences of trustworthy physicians teach that the abuse of spirituous liquors leads to blennorrhea even in ordinary life (323).

Article 138.

cc) When dust lodges in the eye the activity of the conjunctiva becomes abnormal. When the dust is purely siliceous and has merely a mechanical action, it usually produces less lacrimation, reddening, and photophobia than in the following circumstances. Dust causes chemical changes as well when it is composed of cretaceous, calcareous, nitrous, or sal-ammoniac elements. Moreover, the longer that either action continues, the more firmly established does the resultant reaction become. Any person who saw how several thousand soldiers were often for whole days covered with dust (so thick that it was almost impossible to distinguish the color of their uniforms, of their faces, and of their hair) certainly does not doubt that this etiologic factor is of

(318) See Articles 178-179.

(319) See the "Bericht" of Doctor Fischer, director of the military hospital, dated Liége, September 8, 1815.
See the "Bericht" of Doctor Wegler, director of the military hospital, dated Coblenz, September 20, 1815.

(320) According to von Ribbentrop's statement, each soldier carries between forty-five and fifty pounds. See von Ribbentrop's "Archiv", 1. c., volume 1, pages 408 and 415, number 2, 1819.

(321) See Articles 124-126.

(322) See the book by Larrey, 1. c., volume 1, page 216.
See the German translation of the French text of Frank, 1. c., page 48.

(323) See the book by J. C. Reil, "Memorabilium clinicorum", 1. c., Fasc. 1, page 67.
See the book by P. F. von Walther, "Medicinische Beobachtungen", 1. c., pages 458-459.

material influence. Obviously the Allies suffered much harm from that fine, corrosive dust which always pervaded the limestone roads of the south in dry weather. Large numbers of the Egyptians always fall sick when the hot, sand-laden khamsin [wind arising in the Sahara] blows over wide stretches of land. It is well known that the inhabitants of the calcareous regions of Roche-Guyon, of Sologne, of Malta, and of Boulogne suffer almost perpetually from trachoma (324).

Article 139.

dd) The modern fashion of close-cropped hair, which has gained wide popularity among soldiers, is certainly largely responsible for the great frequency of ocular blennorrhea, partly because of the altered electric tension of the scalp, partly because of catching cold easier. There is no doubt that various facts make the harmful effects of that practice involve the eye, in circumstances in which scrupulous personal hygiene is possible; how much more severe, therefore, must such effects be during campaigns, where we so often lack any protection against the harmful effects (325).

Article 140.

ee) The right eye is more subject to blennorrheas than the left eye is. In most of the patients examined by me the right eyeball became affected either earlier or more seriously then the left one did. In almost all cases where just one of the two eyes suffered trachoma, I saw that it was exclusively the right eye. Larrey observed that, in Egypt, when one eye was lost, it was invariably the right eye which was destroyed (326). Omodei reports similar findings encountered in Italy (327). Probably the left eye is less liable to contract trachoma because we usually close that eye in the presence of both strong light and thick dust, and thus we almost always keep just the right eye open (328). Larrey believes that another contributing factor in the creation of that predisposition is "the habit which most people have of sleeping upon the right side, so that this part of the body is the first to feel the dampness of the ground", in camping out (326).

Article 141.

ff) Previous attacks of ocular blennorrhea, almost as a rule, have as sequela a tendency toward recurrence of the disease. Although the essential symptoms of the anomaly have long since disappeared, there often remains either secondary loss of cohesion on the part of the palpebral conjunctiva (329) or marked weakness associated with increased sensitiveness; for this reason the eye reacts out of all

(324) See Chamseru, 1. c.
See Assalini, 1. c., pages 106-109.
See Bongiovanni and Marescotti, quoted by Omodei, 1. c., page 4.
See Olivier, 1. c., volume 2, pages 143-144.
See the German translation of the French text of Frank, 1. c., pages 70-73.

(325) See the book by P. F. von Walther, "Physiologie des Menschen", 1. c., volume 1, page 374.
See J. G. Beer, 1. c., 1792 edition, volume 2, page 44.
See Harcke, 1. c., pages 61-68.
See Hufeland, 1. c., page 110.

(326) See the book by Larrey, 1. c., volume 1, page 209.

(327) See Omodei, 1. c., page 111.

(328) See Articles 136, 138.

(329) See Article 26.

proportion even to minor stimuli (330). In either case, patients are extraordinarily liable to suffer recurrences of logado-blennorrhea at any provocation (331).

b) Causae disponentes making the eyes susceptible to blennorrhea rather through systemic disease.

Article 142.

aa) Several foreign writers, as well as myself, have observed that young, delicate, weak individuals - with pale looks, low resistance, and narrow chests - frequently contract trachoma during campaigns (332). Apart from that, in such natures the respiration is not powerfully developed and is very apt to be seriously impaired by the burden of the soldier's pack upon the shoulders and chest. But in the following conditions the susceptibility to blennorrheas is noticeably increased in all organs of secretion, and especially in the conjunctiva, which latter is simultaneously a prey to other influences:

where it is impossible to breathe with complete freedom, and consequently there is insufficient oxidation;

where, as a result, a preponderance of unburned combustible material forms;

where, in this way (to the detriment of the oxidized formations depending on the red corpuscles), there accumulate increasingly frequent gelatinous and albuminous elements, serum, lymph, and mucus.

Walther has admirably shown how, in accordance with the very same law, susceptibility to blennorrhea is present in everyday life, both in childhood and old age (333).

Article 143.

bb) The lower classes and the privates in the army are primarily the ones who contract the Egyptian ophthalmia; they do so all the more commonly as they can less afford to provide themselves with wholesome food, warm clothing, and suitable shelter. Food which is coarse, heavy, spoiled, rancid, and not prepared right (since it is not completely assimilated by men who are physically exhausted) produces acrid lymph and almost always increases stubborn tendencies toward anomalous secretions of mucus in general, and toward logado-blennorrhea in particular (334). Similar effects are produced by: poor, tattered articles of clothing; living quarters which are cramped, musty, damp, and dirty; frequent colds; constant neglect to bathe; and breathing vitiated air (335). The fact that the rich can to a certain extent avoid the evils just mentioned must be regarded as the chief reason why: 1- officers

(330) See Article 91, paragraph ee, the stadium reconvalescentiae.

(331) See Article 26.
See Article 91, paragraph ee, the stadium reconvalescentiae.
See Articles 127, 190.
See the German translation of the English text of Vetch, 1. c., page 4.
See Assalini, 1. c., page 117.

(332) See the German translation of the English text of Vetch, 1. c., page 45.
See the German translation of the French text of Frank, 1. c., page 50.

(333) See the book by P. F. von Walther, "Medicinische Beobachtungen", 1. c., pages 449-458.

(334) See Article 144.

(335) See Articles 83, 138, 151, 153.

and the upper classes of the civilian population remain immune, for the most part, no matter how much trachoma rages among the other classes; and 2- the freeborn population, the monks, and the mamelukes, particularly in the region of the Nile, do not suffer even when the epidemic strikes down thousands of the poor (336).

Article 144.

cc) All persons as yet not inured to the hardships of war are unusually susceptible to logado-blennorrhea, for two reasons. The more unfamiliar the harmful influences, the severer are always their actions on the body. Persons unfamiliar with the new mode of life have not yet learned the proper way to meet many situations which they find very distasteful. For that reason it was everywhere seen that members of the Landwehr, volunteers, and even conscripts who had rushed from their native land straight to battle were far more commonly stricken than hardened veterans, than the regulars (337).

Article 145.

dd) Most individuals with dyscrasia or cacochymia contracted trachoma while afield (338). Elsewhere I have already expressed my views on the subject of how such systemic diseases vitiate the lymph more or less, and thus help to pave the way for trachoma (339). In general, persons who had not fully recovered from scrofula, syphilis, arthritis, and scabies were extremely susceptible. Of those dyscrasias, scrofulosis was most apt to lead to trachoma. When Doctor Zitterland and I carefully examined several hundred eye patients we noticed two points. In most cases their parents were sickly, cachectic, and consumptive. Many of the patients themselves had previously suffered from scald head, swollen cervical glands, chronic eruptions, and ulcers. Predispositions arising from syphilis proved to be less common; it is noteworthy here that patients cured of gonorrhea were always much more susceptible to trachoma than were patients cured of other forms of venereal disease. Gouty persons usually suffered trachoma during cool rainy weather. Patients with impetigo which was improperly treated most often presented logado-blennorrhea with incurable organic secondary diseases.

Chapter III. Occasional causes of logado-blennorrhea.

Article 146.

The stronger the tendency toward trachoma, the more certainly will the occasional causes produce this disease (340). That is why, in many cases, insignificant causes are able to bring about dangerous forms of logado-blennorrhea, while in other cases no serious damage results from markedly untoward influences, even from more intensive contamination by the virus. In order to give a clear outline of all factors concerned here, I shall first discuss in general those causal relationships which occasion the outbreak of the disease by stimulating the conjunctival tissue to increased secretion; I shall next discuss in particular the virus of contagion which occasions trachoma in a wholly individual way.

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(336) See Articles 111, 125.
See the German translation of the English text of Vetch, 1. c., page 6.

(337) See the German translation of the English text of Vetch, 1. c., page 2.
See Omodei, 1. c., page 4.

(338) See Articles 87, 111.
See the German translation of the English text of Vetch, 1. c., page 44.
See Ware, 1. c., page 8 of Appendix.

(339) See Article 87.

(340) See Article 135.

A. Various conditions which markedly
increase the process of secretion in the conjunctiva.

a) Occasional causes which directly stimulate the conjunctiva to excessive secretion, and thus excite logado-blennorrhea.

Article 147.

aa) Concentrated animal effluvia do not take long to produce intensive secretion on the part of the conjunctiva and, as a result, ocular blennorrhea. It was a common occurrence for outbreaks of trachoma to result from overcrowding of the military hospitals. Such outbreaks came soonest, however, when: 1- conditions of filth were likewise present; 2- the quarters occupied were seldom whitewashed, scoured, and aired; 3- dressings, body linen, and bedclothes were not changed properly; 4- insufficiently cleansed commodes and urinals for use at night were allowed to remain in the wards; 5- accordingly, the vapors from purulent wounds, feces, urine et cetera were heavily laden with sweat and with the air vitiated by breathing (341). Those facts are not the only ones which show what great strides the disease makes in this way. There is also proof that it is very liable to develop in all overcrowded insanitary orphan asylums and workhouses, in lying-in hospitals not kept up, and in every dwelling which is musty, small, and dirty (342).

Article 148.

bb) Beside the sea the air contains an admixture of muriatic vapors, sometimes to a less extent and sometimes to a greater extent. As the equator is approached these vapors are often so concentrated that they leave crystalline deposits upon the huts, trees, and ground. Although such evaporations are less marked in the north, here, too, the atmosphere near the sea is by no means free from them. Now, it cannot be denied that, at the seacoast in warmer climes, more highly concentrated vapors are very largely instrumental in causing the outbreak of logado-blennorrhea, owing to marked irritation of the conjunctival tissue. In cooler zones, therefore, we are justified in numbering the same cause (though not quite so potent a factor) among the evils which, even in Europe, produce more malignant forms of trachoma at the seaside than inland (343).

(341) See Articles 71, 105, 112-119.

(342) See Article 105.
See G. J. Beer, 1. c., 1813-1817 edition, volume 1, pages 293 and 317.
See the book by P. F. von Walther, "Medicinische Beobachtungen", 1. c., page 401.

(343) See Articles 130-132.
See the French translation of the English text of Priestley, 1. c., volume 1, page 342.
See Olivier, 1. c., volume 2, chapter XI, pages 142 et seq.
See the German translation of the French text of Frank, 1. c., pages 66-68.

b) Occasional causes which indirectly increase the ocular secretions by impairing the process of secretion of other organs.

Article 149.

aa) Decreased secretion in the lower half of the mucosae.

We may imagine that the mucosa, which adjoins the outer skin at all openings of the body, is divided into an upper half and a lower half. So far as secretion is concerned, a manifest antagonism exists between the halves. When secretion is decreased in the lower half (belonging to the intestinal tract, the bladder, and the urethra), it usually increases in the upper half (belonging to the eyes, the nasal cavity, and the lungs). If, on the contrary, secretion in the lower half appears over-active, we almost always find it decreased in the upper half. This correlation forms the basis of several etiologic factors of trachoma, of which the principal ones are listed below.

Article 150.

α) The different forms of logado-blennorrhea caused by decreased secretion in the intestinal tract depend on whether it is the normal activity or pathologically increased activity of the intestines which has decreased.-

Chronic trachoma is usually the result of the first causal relationship, which latter has developed in one way or another. In particular a steady diet of substantial, coarse dishes prepared from ripe legumes and indigestible varieties of cabbage can give rise to stubborn constipation and to this extent can be to blame for trachoma. I found a larger proportion of trachoma cases wherever there were very frequent rations of peas, lentils, beans, millet, white cabbage, and red cabbage. This conjecture is likewise confirmed by the experience of the physicians of antiquity. Hippocrates in particular regards too frequent rations of cabbage and lentils as one of the main causes of trachoma (344).-

Acute trachoma is usually the result of the second cause mentioned above, as evidenced by the following facts. Persons who were victims of diarrhea and dysentery during 1813 and 1814 contracted febrile logado-blennorrhea as soon as the functioning of the intestinal tract was restored to normal. In the last wars diarrhea and dysentery (formerly the commonest diseases peculiar to soldiers afield) were but seldom seen, on the whole, even in the autumn; serious forms of trachoma, on the contrary, prevailed all the more extensively about that time (345). Larrey shares the same opinion, according to his observations made in Egypt (346). Desgenettes and Frank likewise found that febrile trachoma is very apt to follow the abrupt cessation of diarrhea (346).

Article 151.

β) Suppressed urethral secretion causes trachoma even in ordinary life, but it does so far more often afield (347). We can readily understand why gonorrhea in soldiers so commonly leads to trachoma when we stop to consider: 1- that gonorrhea ranks among the most frequent diseases peculiar to soldiers; 2- that it can receive

(344) See Hippocrates, "Opera omnia", 1. c., Sect. VII, page 51.
(345) See Articles 72-73.
(346) See the book by Larrey, 1. c., volume 1, page 209.
See the German translation of the French text of Frank, 1. c., page 74.
(347) See the book by P. F. von Walther, "Abhandlungen aus dem Gebiete der practischen Medicin", 1. c., page 457.

only very incomplete treatment on hard marches, when the men are over-heated and improperly nourished; and 3- that many physicians pay no attention to the natural course of the anomaly and strive merely to check the pathologic secretion by means of local astringents. Several patients, on my giving them a thorough examination, confessed that gonorrhea had immediately preceded their trachoma. Ware, too, saw that many cases of logado-blennorrhea developed among soldiers as the result of untreated gonorrhea (348). Moreover, other noteworthy points are that, on the whole, those cases where the eye disease resulted from an exogenous gonorrheal virus were more infrequent than those cases where it occurred by metastasis, and that patients of the first category always suffered much less than did patients of the second category.

Article 152.

bb) Decreased secretion in the outer skin.

The act of secretion of the whole inner cutaneous lining appears diametrically opposed to that of the whole outer skin, just as that of the upper half does to that of the lower half of the internal mucous membranes. For that reason where the secretion in the outer skin is considerably decreased the secretion in the mucosae is immediately increased, and where it is markedly increased in the former it is below normal in the latter. Obviously this antagonism has been blamed for the fact that forces impairing the process of secretion in the corium produce diseases with over-active mucosal secretion, diarrhea, catarrh, and ocular blennorrhea. Where certain atmospheric conditions of heat and moisture prevail, this is mainly the result of sudden chilling and of the ever-present influences of humidity. In my opinion, the conditions listed below are largely instrumental in producing trachoma among soldiers in this way.

α) Bivouacs often cause logado-blennorrhea. It repeatedly happened that all the soldiers in the Prussian division of the army (who were in good health) who, at the end of hot days, slept in meadows during the cold night, woke up in the morning with reddened and gummy eyes, and photophobia. The inhabitants of the delta contract trachoma soonest when they spend the night upon the bare ground near the Nile. Most of the French soldiers who imprudently exposed themselves to the cool of the evening during the Egyptian campaign fell ill (349).

Article 154.

β) Failure to wear warm enough clothes had a lot to do with the outbreak of trachoma (350). The regulation shakos shown in figures two and four of table five in no wise protect the back of the head against the elements: when it rained, the water ran down along the nape of the neck from the close-cropped hair; when the air was raw, when blizzards were constantly encountered on marches, the exposed occiput always suffered worst of all. Several soldiers ascribed their trachoma to this circumstance in particular. The harmful effects of poorly made foot covering were likewise as great as those of the somewhat unsuitable head covering just mentioned; I myself observed that critical forms of logado-blennorrhea very often broke out among the Prussian troops as the result of worn out, ragged shoes and boots, particularly in bad weather, because the feet were chilled (351).

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(348) See Ware, 1. c., page 11 of Appendix.

(349) See Article 111.
See Olivier, 1. c., volume 2, page 143.
See the German translation of the French text of Frank, 1. c., pages 61 et seq.
See the book by Larrey, 1. c., volume 1, pages 206 et seq.
See Assalini, 1. c., page 110.

(350) See also Articles 178-179.

γ) Sojourns in localities with an abundant water supply commonly produce trachoma in the manner already described, for two reasons. Any air over-saturated with moist vapors hinders perspiration to a marked degree. The atmosphere of those regions undergoes rather sudden changes in temperature at night. In the south as well as in the north, therefore, logado-blennorrhea afflicted almost all soldiers who were stationed for any length of time at the seaside, near lakes, fens, and large streams. Numerous and fully convincing examples thereof are given in detail in the section of this book devoted to history (352).

Article 156.

δ) The autumn season in general, but particularly when the weather is rainy and changeable, is very apt to cause trachoma. This is all the more strikingly observed in the following conditions: the less that protection is possible against dampness and cold; the more that the soldier is at the mercy of those untoward influences during campaigns, for example; the fewer his opportunities to change his soaked clothing; and the oftener that, while drenched himself, he must lie upon wet ground during the severe cold of night. Surely we must regard this as the primary reason why every autumn brought exacerbations of logado-blennorrhea among the Allies (353), and why from the autumn on it reached more advanced stages in both Egypt and Syria (354).

Article 157.

cc) Decreased secretion in secretory organs of anomalous origin.

According to the theory of complications, another cause of logado-blennorrhea is the sudden cessation of the act of secretion on the part of secretory organs of anomalous origin. Furthermore, it is plain enough from my earlier account how readily blennorrheas result, particularly from overly rapid cicatrization of purulent wounds and from sudden healing of chronic ulcers. I therefore refer the reader to my earlier report for a full discussion of this etiologic factor (355).

B. The virus of contagion as the cause of logado-blennorrhea.

Article 158.

Those articles which deal specifically with the properties of the blennorrheal secretion answer such questions as: at what stage of the disease blennorrheal discharges become contagious in nature; when the miasma forms part of the substratum which is fluid and capable of forming drops, and when it is volatilized; what circumstances increase and decrease the virulence of the infectious principle, whereby sometimes its effects are far reaching and sometimes it remains without effect; and in what way contagion can produce an outbreak of the disease within but few hours in some cases, but takes several days to do so in other cases (356). Therefore the only thing left to prove about the etiologic significance of the virus of contagion is its part in the different epidemic forms of the anomaly.

Article 159.

Logado-blennorrhea which develops in many individuals simultaneously does not always result from the presence of the virus of contagion.-

(351) See Article 179.
(352) See Articles 130-131.
(353) See Articles 124-126.
(354) See Articles 111-114.
(355) See Article 88.
(356) See Articles 63-72, 135, 146.

When unfavorable climates and unhealthy local conditions (357) lead only to the milder form of trachoma (watering or the discharge of mucus), the disease shows itself to be purely epidemic or purely endemic (358).-

On the contrary, where such atmospheric influences work considerable harm and lead to the most advanced form of trachoma (the discharge of pus), where an excess of the virus is present in the secretion (359), we see that contagion plainly helps to spread the disease (360). Depending on the other causal relationships, this takes place in two different ways, regardless of whether the miasma is endemic or epidemic (361). In other words, if both the tendency toward logado-blennorrhea and the potency of the virus of contagion proceed from purely local influences, the ensuing trachoma is merely endemic and contagious. If, when the virus of contagion is present, conditions favorable to it are widespread [as opposed to local], the disease becomes most extensive and is epidemic and contagious. Thus genuinely contagious ocular blennorrheas appeared, sometimes being confined to individual buildings or individual communities et cetera, sometimes spreading over wide areas or among vast armies. In the former case the contagious disease prevailed in orphan asylums, maternity homes, and hospitals which were overcrowded and insanitary. In the latter case it was transmitted from one race to another, and migrated from the orient to the occident (362).

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(357) See Articles 135-157.
(358) See Articles 102-105.
See A. G. Richter, 1. c., third edition, volume 3, page 46.
See Demours, 1. c., volume 1, pages 212-213.
(359) See Articles 63-70, 105.
(360) See Articles 105, 127-132.
(361) See Articles 71-72.
(362) See Articles 106-132.

Book five. Treatment.

Part one. Prognosis.

Article 160.

Sometimes, happily, logado-blennorrhea terminates spontaneously in but few days; often great pains must be taken to combat it; and on many occasions the best of methods is insufficient to check the destructive progress of the disease. Since the outcome varies so widely, it is by no means safe to base the prognosis on the prominence of isolated causes, as many have sought to do. The only safe way is for us to consider three fundamental factors in every instance: the existing causal relationships; the stage of development already reached by the disease; and the status quo as regards the polymorphous sequelae (363). In the chapters which follow immediately I shall discuss in turn all the results based on experience of interest here, and I shall do so strictly in accordance with the classification just mentioned.

Chapter I. The relation between the causes and the prognosis.

Article 161.

a) The anomaly disappears readily and quickly if the eye is perfectly sound and has been exposed to the harmful influences for only a short time. If three contitions are fulfilled, even serious causes (fine corrosive dust, catching bad colds, immediate contact with the purulent secretion) often produce only the merest watering, lasting at most for seven days: 1- if the persons affected have never had any eye trouble before; 2- if they are free from dyscrasias; and 3- if, after the onset of trachoma, no further injury has been sustained by the body.

Article 162.

b) Recovery is difficult where the pathologic process is deeply rooted in the tissue owing to untoward influences over a long period. Even persons who had good constitutions, who had received the best treatment, and who had suffered merely from watering never recovered in less than fourteen to twenty-one days when they had previously been exposed for several consecutive weeks to raw weather, fine dust, and other such untoward influences.

(363) See Articles 1-52, 133-159.
See the book by Larrey, l. c., volume 1, pages 204-205, 208-209 et seq.
See Assalini, l. c., page 98.
See Omodei, l. c., pages 81-111.
See Vasani, l. c., pages 19-74.
See the German translation of the English text of Vetch, l. c., pages 18, 21, and 38-39.
See the German translation of the French text of Frank, l. c., pages 53 et seq.
See Baltz, l. c., pages 19-20, 22-23 et seq.
See Kluyskens, l. c., pages 60 et seq.
See Fischer's thesis, l. c., page 20.
See Lehmann, l. c., pages 20-21 et seq.
See Ziermann, l. c., pages 202-203.
See Helling, l. c., pages 16-20 et seq.

Article 163.

c) In the presence of well defined predisposition (364), logado-blennorrhea which is the result of any of the aforementioned occasional causes (365) proves to be exceedingly stubborn. Every form of trachoma produced in such circumstances subsides only in proportion to the patient's predisposition: if the latter is marked, perhaps incurable, recovery from the eye disease incurred is difficult, perhaps utterly impossible. Sometimes, therefore, even when the diseases are mild, radical cure of these conditions is totally impossible of attainment.

Article 164.

d) The case is hopeless when the disease, already well established, is subjected to very harmful influences incessantly. Here the process advances from one stage to the next, until it ends in total destruction of the eye. If trachoma patients remain for a fairly long time in "animalized" air impregnated with deleterious vapors, if on returning to the army they are subjected to much physical exertion and exposed to every variety of inclement weather, most of them lose their sight permanently.

Chapter II. The relation between the stage of development and the prognosis.

Article 165.

a) Trachoma is most apt to go away when it takes the form of uncomplicated watering, free from all deleterious influences. If this purely dynamic form of the disease has lasted only a short time, it generally comes to an end after but few days (five to seven) without leaving any sequelae. Even where such milder forms of trachoma are already beginning to cause organic involvement, as their course is more protracted, it is always still possible to put an end to them within several weeks by resorting to drastic means.

Article 166.

b) Trachoma is more stubborn when it reaches the stage of discharge of mucus. Here the diseased tissue already presents noticeably greater loss of cohesion and consequently much more of a tendency toward the formation of papillae. This particular stage of the disease seldom ends before the fourteenth or twenty-first day, and for the first few weeks thereafter the eye almost always manifests a marked tendency toward relapses (366).

Article 167.

c) Actual blepharo-pyorrhea marks the danger point. Any constant deleterious influence, even if only slight, can readily bring this stage of development to a pitch where total loss of the eye ensues. Here one may hope to save the eye only when all other conditions are favorable in every respect to the attainment of the therapeutic purpose. Moreover, once the palpebral conjunctiva appears affected with a purulent discharge, the process almost never gives way before the fourth week; indeed, often it does not subside until after the fifth or sixth week. In addition, on account of its organic involvement (by this time well advanced), it commonly leaves behind germs which will lead to grave sequelae, and without exception it leaves the eye with a strong tendency toward recurrences for long months (367).

(364) See Articles 135-145.
(365) See Articles 146-159.
(366) See Articles 10-12.
(367) See Articles 16, 21.

Article 168.

d) For the most part inevitably, vision is destroyed and the structure of the eyeball is more or less destroyed in ophthalmo-pyorrhea. If there is genuine formation of papillae in the ocular conjunctiva, even if the disease has not affected the corneal tissue to the same degree, trachoma almost never terminates without having left amblyopia, amaurosis, large specks, deep ulcers, prolapse of the iris, cataract, staphyloma, or other sequelae harmful to the sense of sight. Where the development of true granulations already extends over the ocular conjunctiva as far as the corneal lamellae, the general form of the eyeball suffers in part or in toto just as the eyesight does (368).

Chapter III. The relation between the tendency toward certain sequelae and the prognosis.

Article 169.

a) Sequelae affecting the lids are common after logado-blennorrhea because the palpebral conjunctiva serves as the natural breeding place of trachoma (369).

aa) Subsequent loss of cohesion on the part of the palpebral conjunctiva seldom results from watering; more often it results from the discharge of mucus, and it results regularly from the discharge of pus. Once it has taken place, when mild and uncomplicated and untreated, it lasts for eight to fourteen days after watering, for some weeks after the discharge of mucus, and for several months after the discharge of pus. When there is deep organic involvement trachoma responds only to suitable medical treatment. If incurable dyscrasias are responsible for it, it defies the most classical remedies and sometimes lasts as long as life. Throughout its duration every victim is very likely to suffer recurrences of the original anomaly (370).

bb) Sarcomatous ectropion is to be expected where papillae abound during the fastigium of trachoma, and where reposition of fungous eversions of the lids has been performed too late or else the eversions have not received proper treatment. If the necessary drastic treatment is not applied to these well advanced conditions they always give rise, in the course of time, to destruction of the eyeball by ulceration or to palpebral scirrhus (371).

cc) Entropion takes place when, in the absence of marked granulation of the palpebral conjunctiva, mild blepharo-blennorrhea continues over a very long period, when it lasts for long years. We must always check this condition at an early date, for the trichiasis developing apace with it always turns the cilia inward, producing inflammation or opacities and ulcerations of the eyeball (372).

dd) Ptosis follows when the contractility of all ocular membranes is considerably diminished through hypersecretion of pus, through marked edema of the lids, or through heavy drooping associated with ectropion. Mild ptosis following trachoma sometimes disappears even without medical assistance; more severe ptosis, on the contrary, never yields save to definite therapeutic measures (373).

(368) See Article 17.
(369) See Article 25.
(370) See Article 26.
(371) See Article 27.
(372) See Article 28.
(373) See Article 29.

Article 170

b) Sequelae affecting the bulbar conjunctiva are to be feared chiefly where this membrane presents greater sympathetic reaction in logado-blennorrhea (374).

aa) Ocular films of every type form when the bulbar conjunctiva presents either marked sympathetic inflammation or marked blennorrheal loss of cohesion. If there is an appreciable increase of the vascular network appearing with the inflammation in the conjunctiva bulbi just mentioned, true pannus-like deformities seldom fail to take place. Pterygium is likely to appear where, in the final stage of the primary process, the loss of cohesion present throughout the bulbar conjunctiva does not disappear uniformly. Neither cellulous nor vascular films over the eye ever disappear naturally. We can obtain their cure artifically if they are merely in the initial stages in persons who are otherwise healthy. If their development is not checked these sequelae lead to total destruction of the eye sooner or later (375).

bb) Ulcerations of the bulbar conjunctiva are inevitable if those numerous vessels which, in sympathetic inflammation, cover the entire conjunctiva bulbi like a network are at some points grouped together to form compact convex bundles, provided at the tip with lymph vesicle. At first such minute ulcers are easy to cure. When unchecked they produce all the polymorphous sequelae affecting both the eyesight and the form of the eyeball which, in general, are to be feared from progressive ulcerative diseases of the eye (376).

Article 171.

c) Sequelae affecting the cornea threaten all individuals in whom logado-blennorrhea is well advanced in extent (377).

aa) Corneal opacities usually develop during the fastigium of the primary disease. Whether they are blennorrheal or inflammatory, at first they always take the form of gray dots lacking in luster and looking as though covered with dust (378). Sometimes there is spontaneous disappearance of both types of opacities when they have not yet become extensive, and when they occur in persons with a good physique who have not been exposed to any untoward influences. At first their cure is almost always certain. When neglected they are very apt to form the basis of lasting adynamic opacities (379), synechias of the iris, corneal staphylomata, and destructive ulcerations (380).

bb) Corneal staphylomata develop when the dynamic opacities just mentioned penetrate from the outer to the innermost lamellae of the cornea (381). Extension staphylomata in particular are inevitable if, in the presence of blennorrheal speaks, the diseased cornea protrudes when the anterior chamber enlarges without prolapse of the iris. Adhesion staphylomata are just as certain to appear when, in the presence of inflammatory corneal opacities, the inflammatory process attacks the iris to intensively that both the iris and the diseased cornea begin to prolapse appreciably. Radical cure of such staphylomata is possible only in their early stages. Later on they always occasion lasting impairment of sight, and often occasion total destruction of the eye (382).

(374) See Article 30.
(375) See Article 31.
(376) See Article 32.
(377) See Articles 33-43.
(378) See Articles 35-36.
(379) See Article 37.
(380) See Articles 34-37.
(381) See Articles 38-40.
(382) See Articles 38-40.

cc) Corneal ulcers take place in logado-blennorrhea as soon as there is considerable involvement of the outermost layer of the cornea in several places. It is evident that inflammatory ulcers are imminent when corneal opacities intermingled with many small vessels are elevated, at the tip, to form a pustule. When checked in time these ulcerations leave a small leucomatous opacity. Where these ulcerations gradually penetrate deeper and affect the innermost corneal layer, they create collections of pus in the anterior chamber and, very soon, independent staphylomata of the iris. As regards the second variety of corneal ulcers (namely, ulcers due to resorption), they are evidenced by the fact that, at a very early date, the clear cornea presents a few very lustrous and very transparent points. Ulcers of this species, when properly treated, are followed by perfectly transparent scars recognizable only from partial solution of continuity. When such ulcerations have already started to penetrate, although they almost never cause hypopyon, they do cause prolapses of the iris; such hernias are gradual and therefore, for a long time, they can be reduced (383).

Article 172.

d) Sequelae affecting the iris have three general causes: inflammatory corneal opacities succeed in reaching the tissue of the iris (384); in penetrating corneal ulcers, part of this tissue prolapses (385); the blennorrhea in the iris takes place strictly by metastasis (386).

aa) Synechias of the iris (387) are imminent if, in inflammatory opacities developing at the circumference of the cornea, the iris turns red and swells up at its ciliary margin, while the eye becomes more sensitive. When such anomalies (consisting merely in superficial conglutination of iris and cornea) remain circumscribed, they give rise to insignificant distortions of the pupil which impair vision but little. On the contrary, in the cases where such synechias extend from the ciliary ring well toward the inner margin of the iris, patients lose their sight permanently (owing to major distortions of the iris or to complete atresia of the pupil) unless perchance definite operations are still of avail (388).

bb) Staphylomata of the iris are seldom avoidable after portions of the iris, prolapsing as the result of corneal ulcerations, have fused with the rim of the ulcer. Only while the ulcer is very small and the prolapse of the iris can still be moved a little is it sometimes possible to prevent formation of the staphyloma. Where the prolapsed piece of iris (no matter how small) appears firmly attached to the cornea, the sequelae are myiocephalon and (when the latter is cured) pupillary distortions, together with large corneal specks which are black in the center (389). In those individuals in whom the iris prolapses through a single large corneal opening, the prolapsed part when untreated is sooner or later transformed into a true melon, always accompanied by complete destruction of the pupil. If a myiocephalon occupies each of multiple perforations in the cornea, complete staphylomata racemosa (always accompanied by destruction of the eye) develop from the confluence of these prolapses of the iris, unless preventive measures are taken in time (390).

(383) See Articles 41-43, 172.
(384) See Article 45.
(385) See Article 46.
(386) See Article 47.
(387) See Article 45.
(388) See Article 45.
(389) See Article 171, paragraph cc, corneal ulcers.
(390) See Article 46.

cc) Subsequent blennorrhea of the iris develops either from direct propagation of conjunctival blennorrhea or from metastatic transportation of conjunctival blennorrhea (391). The former is to be feared when logado-blennorrhea attacks the cornea itself; the latter is to be feared when logado-blennorrhea is forcibly checked by severe cold or by repulsives (392). The first symptoms of secondary blennorrhea of the iris are usually increased sensitiveness of the eye, boring pain in the orbit, increased photophobia, more marked tearing, and appreciable tension of the cornea. If this sequela does not go beyond the stage of watering, many persons still recover completely when the treatment applied is early, judicious, and drastic. When it reaches the stage of discharge of mucus, a cure can seldom be hoped for any longer. When it takes the form of discharge of pus, the prognosis is always gloomy: here, even when the flow of pus is scanty, complete recovery is almost never possible; where there are larger collections of pus filling the anterior chamber, vision is lost entirely and the shape of the eye is spoiled in large measure in spite of the most skillful treatment (393).

Article 173.

e) Sequelae affecting the lens and the vitreous are imminent if, by means of sympathetic inflammation, logado-blennorrhea acts on the deeper, pellucid membranes of the eye (394). As a rule, successful surgical removal of pure cataracts caused in this way is possible after the blennorrhea has cleared up entirely. True glaucoma brought on my blennorrhea, on the contrary, makes its victims blind for life (395).

Article 174.

f) Sequelae affecting the retina are frequently seen after the Egyptian ophthalmia because it never takes place without simultaneously involving the nervous system of the eye (396).

aa) Secondary photophobia results particularly when the nervous system of the eye, in the course of logado-blennorrhea, undergoes pathologically increased activity out of all proportion. Although many persons recover from secondary photophobia when it is mild, their recovery is always very slow, seldom taking place before the third week after the symptoms of the primary disease have cleared up entirely. When secondary photophobia is severe, it resists even the most drastic measures for months and is very apt to turn into photopsia, chromatopsia, or amblyopia (397).

bb) Secondary amblyopia and amaurosis are actually caused by ocular blennorrhea far oftener than is commonly believed; I feel obliged to stress this point. Erethistic amblyopia and amaurosis are particularly to be feared where severe photophobia and chromatopsia, at the fastigium of trachoma, last very long, or where secondary photophobia is incurable. We fear torpid amblyopia and amaurosis when unusually copious secretions occur during the fastigium of the primary disease, when scanty blennorrheal discharges last unusually long, or when chronic trachoma comes to a sudden end. Unfortunately, cure of amblyopia is but rare, whether the erethistic or torpid form follows logado-blennorrhea. In complete amaurosis occa-

(391) See Article 46.
(392) See Article 47.
(393) See Article 47.
(394) See Article 48.
(395) See Article 48.
(396) See Article 49.
(397) See Article 49.

sioned in the manner described, where complete loss of vision dates back some time, experience up to the present teaches that the sense of sight can never be restored (398).

Article 175.

g) Sequelae affecting the central vascular system are nearly always incurable (399). Only mild dropsy of the ocular chambers subsides without destroying the function of the sense [of sight] ; more advanced dropsy never does so. Dropsy of the vitreous always destroys sight and very often spoils the shape of the eye. Only a few persons recover completely from incipient atrophy of the eye; advanced stages of atrophy destroy the power of vision without exception, and the form of the eyeball in almost every case (400).

Part two. Prevention

Article 176.

There is but little that we can do directly to prevent trachoma. To be sure, the Egyptians recommend the rubbing in of kohl (401) in the vicinity of the eyes and the washing of the eyelids with antimony decoctions, with milk, with vinegar, with lemon juice, or with alcohol as efficient prophylactics. In Germany, likewise, solutions of eight to sixteen drops of Vauquelin's Prussic acid in six ounces of distilled water, as well as collyria containing one drop of diluted suphuric acid and one ounce of rose water are repeatedly recommended for the same purpose. Nevertheless, closer observation shows that all these remedies have by not means proven their worth (402).

We stand a much better chance of preventing trachoma indirectly. Four principles are involved here: first, we must prove whether many individuals who will inevitably be exposed to logado-blennorrhea by serving at the front are to be declared totally unfit for the army; secondly, we must prove by what preventive measures a healthy person avoids the more important causes of the disease as much as possible; thirdly, we must consider how trachoma can be checked early enough; and fourthly, we must list the steps to be taken by all convalescents to protect themselves more surely from recurrences. I shall give a detailed discussion of prophylaxis in logado-blennorrhea in accordance with the four principles just laid down.

(398) See Article 51.
(399) See Article 52.
(400) See Article 52.
(401) Frank (l. c., page 76) says that kohl is obtained in a special way from the smoke black of frankincense.
(402) See Assalini, l. c., page 131.
See Omodei, l. c., page 11.
See the German translation of the French text of Frank, l. c., page 76.
See Chamseru, l. c.
See pages 141 and 150 of the article by P. F. von Walther in the Journal der Chirurgie und Augen-Heilkunde, volume 2, pages 36-165, number 1, 1821.

Chapter I. Selection of recruits in relation to prevention of logado-blennorrhea.

Article 177.

Those who are unfit for a military career are: youths of a delicate and weakly constitution - with pale looks, low resistance, and narrow chests (403) -; and persons who never in their lives have been entirely free from cacochymia, in whom scrofulous dyscrasias in particular continue to be serious (404), and whose eyes become much reddened (405) in cold, stormy, or dusty weather, as after every exertion (no matter how slight). Persons with such constitutions never fail to contract trachoma soon when on campaigns, owing to the many harmful influences which cannot be prevented altogether even when every precaution is taken. It is noteworthy here that medical judgment passed on the selection of recruits is attended with great difficulties in general, and in particular where all the factors just mentioned must likewise be taken into consideration. The more that people are convinced of this truth, the more definitely should that important task never be entrusted to subaltern health officers, but always solely to men possessing much knowledge and wide experience.

Chapter II. Means of avoiding the causes of trachoma and of diminishing the force of the unavoidable causes.

Article 178.

a) Clothing of able-bodied soldiers.

aa) Head coverings of the kind introduced for the infantry and cavalry (shown in figures two and four of table five) leave a great deal to be desired as regards their influence on health. When regulation shakos are worn for a fairly long time, they are very apt to cause marked congestion toward the head, for three reasons. In order to make them rest more upon the crown of the head, they are made too tight at the bottom. At the same time they are over-weighted with various decorations, with long plumes, cordons, tassels, and braid. They have the shape of an inverted cone, with the wider part uppermost; consequently they stay in place only when the neck is kept in a strained position or when the chin straps are fastened too tight. Another fault to be found with shakos is that in general they offer insufficient protection, and that in particular they leave both temples and the occiput exposed; those are the very parts which not only are most apt to sustain dangerous wounds, but also are most sensitive to the harmful actions of wind, rain, and cold (406). Lastly, these head coverings likewise appear to fail to shield the eyes; their visor is obviously too small and, not covering the eyebrows, is pressed so flat against the forehead that it can be of no assistance in protecting the eyes against glare, dust, and wind (407). All the defects noted must be eliminated. Only when the soldier discards that heavy ornament for a light-weight head covering giving real protection, and when a broad leather peak in front shades the eyes and a similar peak in back protects the nape of the neck sufficiently, will shakos not only be without disadvantage but will be of real advantage. The different types of helmets (as efficient as they are beautiful) used by the Greeks and Romans in battle show

(403) See Article 142.
(404) See Article 145.
(405) See Articles 140-141.
(406) See Article 153.
(407) See Figures two and four of table five.

how easy it is to meet these requirements, even without depriving the soldier of a flattering appearance (408).

In conclusion, I wish to stress another fact, that some attention should be paid to the natural covering of the head by the scalp. Close-cropped hair has clearly been responsible for dangerous trachoma in many cases (409). Wearing one's hair long while afield is attended with difficulties in more respects than one. In order to avoid both extremes as much as possible, it seems to me that the braided queue (folded back tight and encircled once by a clasp) customary in the French army is very much worth recommending. It holds the hair together properly without requiring much care, it keeps the back of the head warm, it prevents water from running down the back and saber cuts from piercing the nape of the neck without giving soldiers an unslightly appearance at all.

Article 179.

bb) Military uniforms have recently been improved in various ways, it cannot be denied. Nevertheless, from the viewpoint of general health, a few points still need to be changed.

It is obvious that the pockets in the uniforms are much too small; they force the soldier to use the spare room in his shako to stow away indispensable small objects; in this way they make the head bear a heavier load and make the head hotter.

Furthermore, the neck is constricted by the stiff collar fitting snugly under the chin (410), just as the tight waistband constricts the abdomen. Congestions toward the head and disturbances of the functions of chest and abdomen are all the more certain to follow, in this way, because modern tactics require soldiers to make forced marches much faster than formerly.

The only serious complaint that I ever heard about the regulation of our military foot covering was that, on campaigns, the footwear as a rule was not repaired sufficiently and was replaced too seldom (411). Since trachoma develops very readily from deficiencies of the latter kind (particularly during bad, muddy weather, when the lower extremities are chilled), it is the physician's bounden duty to appeal often enough to high officials, urging remedy of this evil (412). Over a hundred eye patients who arrived at Saint Cecilia's Military Hospital in Cologne after long marches were so ragged that more of their feet was exposed than covered. I at once had new shoes and boots issued, whereupon Doctor Zitterland and I observed that all those individuals improved from day to day as soon as the temperature of their lower extremities had returned to normal (413).

We are indebted chiefly to the introduction of large, warm cloth cloaks for the fact that, in the last campaigns, diarrhea and dysentery were seen far less than formerly. The advantage of this cloak would be still greater if a hood were fastened to its upper part (in order to protect the head, the nape of the neck, and the

(408) See the German translation of the English text of Potter, l. c., volume 2, pages 54-60, table 2.
See Lipsius, l. c., volume 3, page 143.

(409) See Article 139.

(410) See figures two and four of table five.

(411) This applies only to shoes and boots. The experienced soldier never wears stockings on long marches because stockings offer him far less protection against chafing from walking than does wrapping the feet properly in tallowing cloth [wax cloth].

(412) See Article 149.

(413) See Article 154.

face as completely as possible). The soldier could pull such a hood over his shako during bivouacs and marches in bad weather, though not while standing guard (when the law forbids any muffling of the eyes and ears). Maurice de Saxe [1696-1750, marshal of France], of wide military experience, warmly recommends such caps, and General Menu issued them with distinct advantage to the army under his command during the Franco-Egyptian campaign (414).

Article 180.

b) Conservation of energy.

Sensitiveness to untoward influences in general, and consequently also to those productive of logado-blennorrhea (415), increases in direct proportion as resistance is seriously lowered. In war times, when unavoidable heavy strains often come in swift succession, all unnecessary exhaustion must be most carefully avoided in order to prevent trachoma. -

So far as the individual is concerned, he meets this requirement by giving all dissipation a wide berth. On several occasions I noted severe outbreaks of trachoma right after intoxications. Even the physicians of antiquity, the foremost of them Avicenna, forbid all over-eating as a means of preventing trachoma (416). Larrey and Frank both assert that sexual intercourse must be positively forbidden in epidemic trachoma (417). -

So far as groups are concerned, military leaders can be of great assistance in preventing trachoma by sparing their columns on expeditions. Commanding officers will find that the average incidence of trachoma in their divisions will be lower if the soldiers are allowed sufficient rest periods, if during long marches on sultry days care is taken to have wagons carrying cloaks and knapsacks follow the regiments, and if they are careful not to give the newly organized troops the hardest tasks immediately (418).

Article 181.

c) Cooling and cleansing of the eye.

During hot weather, the eyelids must be gently bathed with fresh, clear well water as often as required to get rid of the dust and of accumulations of caloric matter (419). The good effects of this are shown by the greater freedom with which the eyeball can be moved immediately afterwards, and by a simultaneous diminution of photophobia. It is self-evident that cold ablutions of this kind must not be permitted while the face is heated, and that we must forbid them where in certain types of idiosyncrasy (usually dependent on an arthritic diathesis) moisture of all kinds must be kept away from the skin of the lids. Prospero Alpini praises the water of the Nile as a very efficacious means of prevention (420). White saw large

(414) See the German translation of the French translation of the English text of Monro, l. c., volume 1, page 22.
See the German translation of the French text of Frank, l. c., page 62.

(415) See Articles 133-138.
See C. F. Graefe's "Die Kunst, sich vor Ansteckung bei Epidemien zu sichern", l. c., pages 23-40.

(416) See Avicenna, l. c., Lib. III, Fen. III, Tractat. I, Cap. 5.

(417) See the book by Larrey, l. c., volume 1, page 208.
See the German translation of the French text of Frank, l. c., page 76.

(418) See Article 129.

(419) See Article 138.

(420) See Alpini, l. c., page 24.

divisions of soldiers remain free from trachoma after the use of cold water had become a routine procedure (421). Bruant and Omodei both assert that bathing the eyes with pure well water is the best way to prevent trachoma (422).

Article 182.

d) Measures to prevent contagion.

There are qualified practitioners who expect to prevent infections of every king simply by using alkalis and acids, and other experienced physicians who deny that the very same remedies have any value in checking contagion. For my ownpart, I find it impossible to share either viewpoint. -

Wide experience with typhus contagiosus recently showed that the abovementioned chemical forces very often have protective power (423). Their effect on the miasma of trachoma as well is evident from several facts, particularly from the following ones.

The efficacy of volatile potash as a prophylactic is at once evident from the fact that there was no contagious spread of the Egyptian ophthalmia among cavalrymen, who are constantly surrounded by concentrated and peculiarly pungent ammonium vapors, owing to the steaming of the horses (424).

Walther observed that the gray vapors in fumigation of infected sick rooms with nitrate were very successful in destroying the virus of trachoma (425).

Since several trachoma patients became a little worse when the vapors of chlorine, nitrate, and ammonium were perhaps too highly concentrated, I later employed pure alkalis as well as acids mainly for the disinfection of unoccupied rooms, old furniture, and articles of clothing that had been worn before. Not once did anything happen to make me feel that I had not fully achieved my purpose.

It is true that other observers have not obtained equally good results, that many have never had any success with these preventive measures. The sole explanation of this contradiction is that, although the reagents listed have a protective force, this force by itself is insufficient to check contagion save when one also scrupulously observes the rules by means of which the principle of contagious is prevented from becoming more virulent (426), or else spreading of the virus is carefully prevented (427). The following articles will show how we now prevent such infections everywhere (at the front as well as in hospitals) by observing the principle just mentioned, which is based on facts.

Article 183.

aa) Spreading of the virus of contagion right at the front is prevented mainly by taking the precaution of early isolation. We separate the trachoma patients from the healthy men either without detaching them from their regiments, or in such wise that they are kept entirely apart from the army.

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(421) See White, quoted by Omodei, l. c., page 11.
(422) See Bruant, l. c., pages 99-100.
See Omodei, l. c., page 10.
(423) See C. F. Graefe's "Vorläufige hohen Orts genehmigte Instruction für die ärztlichen Dirigenten und Oeconomiebeamten der Militair-Lazarethe", l. c., page 15 and supplement M.
See G. A. Richter, l. c.
(424) See Articles 111-131.
(425) See page 151 of the article by P. F. von Walther in the Journal der Chirurgie und Augen-Heilkunds, volume 2, pages 36-165, number 1, 1821.
(426) See Article 71.
(427) See Articles 111-131.

The *first* form of isolation is employed when the physician has all eye patients grouped together in one column while on the march, and while in quarters assigns them special houses far enough away from the dwellings of the other troops. It is of unusual advantage to provide such groups of patients with ambulances to transport all patients or at least the worst cases. By thus avoiding physical hardships, overheating, and severe congestions toward the head we remove serious evils which otherwise soon exacerbate the disease to a dangerous degree.

The abovementioned *second* form of isolation calls for immediate transfer of every victim to the nearest hospital after the outbreak of trachoma. Although in this case convalescents can no longer rejoin their regiments directly when the army is constantly on the move, as compensation the victims are more surely spared the continued action of baneful influences, and the able-bodied the danger of infection.

Wherever circumstances at all permit, the second form of isolation must therefore be preferred to the first.

Article 184.

bb) *Proper regulations for the prevention of contagion in hospitals are of the utmost importance*. If hospitals do their part, if the Egyptian ophthalmia is not contracted by individuals who are free from eye trouble but are in the hospitals for treatment of other diseases, if patients with mild logado-blennorrhea do not lose their sight where there is hope of preserving it, if hospitals do not serve as the breeding ground of an intensive virus of the most destructive kind, *we are sure* of four things. First, generally speaking, there has been proper isolation of patients admitted. Secondly, they have been kept far enough apart from one another. Thirdly, all requisite measures for the promotion of sanitation have been taken. Fourthly, all those discharged have been freed from the virus of contagion as much as possible.

Article 185.

α) *As regards the hospital isolation noted*, the *chief* thing is to put each trachoma patient in a private room. When the patients are few in number, they should be assigned a suite of rooms not communicating with the other parts of the military hospital. When, on the contrary, there are more patients, they should be assigned to whole buildings far enough away from other hospitals. This is necessary regardless of whether the cases of trachoma are severe or mild because, sooner or later, even the mildest forms can reach advanced stages and become contagious. After that general isolation has been carried out properly, the *second* step is to segregate the patients with febrile trachoma from those with afebrile trachoma by means of separate rooms. When pyretic patients were occasionally grouped with apyretic patients, the latter repeatedly contracted the form of the disease presented by the former. The *last* step is to ensure complete isolation of every single trachoma patient; otherwise patients presenting the different mild forms contract the different advanced forms of the other patients in their rooms. Now, achievement of this purpose depends on two things: whether it is possible for each patient admitted to have for his sole use a bedroom, washing utensils, compresses, eye bandages, and eyeshade, a brush, an eye dropper, et cetera; and whether it is possible for assistant medical officers who cleanse the eyes of trachoma patients to wash and dry their hands, as a routine procedure, between each case.

Article 186.

β) *After proper isolation, trachoma patients must also always be kept far* *enough apart from one another*. Where whole hospitals or separate rooms are overcrowded, in time ventilators of all kinds do not suffice to purify the air. Now, since any strongly "animalized" atmosphere exacerbates trachoma and in particular makes it more contagious (428), the physician overlooks one of the most important preventive measures if he does not see to it that the rooms contain only the number of patients compatible with the dimensions in question. In rooms of average size (429), the space of five hundred cubic feet per individual is usually calculated on; but in contagious logado-blennorrhea it is well to allow at least eight hundred cubic feet, and even one thousand cubic feet when possible, for each patient.

When we consider the preventive measures already listed in the foregoing articles and all those still be be discusses, it is evident that isolation more rigorous than the kind just described would be superfluous. Although, in order to be surer of preventing contagion by employing fresh air, several persons have given patients separate barracks, or distributed patients in the country, both these measures should but seldom be necessary when the instructions noted have been scrupulously followed. The bad feature of *separate barracks* is that the advantage derived by the trachoma patient in them from less "animalized" atmosphere is offset by other serious disadvantages which are the natural concomitants of life in the open. The same criticism applies to unqualified praise of *boarding patients out in the country*, for two reasons. Such a procedure sometimes spreads trachoma among the civilian population (430). Here the benefit derived from fresher sir is usually offset by the drawback of having large numbers of patients so scattered that they are too far removed from both general and medical supervision.

Article 187.

γ) *Sanitation in military hospitals is essential to the checking of contagion* (431). This is best attained by scrupulously observing the following rules.

Before admission every trachoma patient must be carefully bathed from head to foot with soap and lukewarm water. If he is not free from vermin, he is urged to rub some mercury salve into the hairiest parts of his body after the bath. At this point he receives clean underwear and fresh clothing, and the room assigned to him contains a perfectly clean bed provided with a brand-new blanket and stuffed with clean straw. Let me note in passing that in military hospitals we generally prefer bags of straw to mattresses, for three reasons. It is impossible to replace the stuffing of mattresses for each new arrival. Furthermore, the soldier does not find mattresses softer than straw to lie on, as a rule. Lastly, even pampered soldiers prefer sleeping on a bed freshly stuffed with hay, straw, or dry moss to sleeping on bolsters that have already been used by many patients. Therefore mattresses should be issued only in exceptional cases to a few individuals, those badly wounded, fracture cases, and so forth.

Hospital patients, for their part, must likewise coöperate in furthering the aims in question as much as possible. In this connection we request certain things of them: not to smoke tobacco inside the hospital; in general, not to engage in any pursuits violating sanitation; to observe scrupulous personal hygiene; not to leave articles of clothing and utensils (regardless of what kind) scattered about, in violation of the rules laid down; and not to keep any food upon the tables or chairs, or elsewhere in the room, after the time set for breakfast, the noon meal, and the evening meal, as forbidden by the regulations.

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(428) See Article 71.

(429) Here I do not refer to rooms over fourteen feet in height, since even in churches, former rooms of state, et cetera the beds must never be placed too near one another.

(430) See Articles 72, 116, 119, 126.

(431) See C. F. Graefe's "Vorläufige hohen Orts genehmigte Instruction für die ärztlichen Dirigenten und Oeconomiebeamten der Militair-Lazarethe", l. c., page 12, Article 10.
See also the summary of this "Instruction" by Augustin, l. c., volume 2, pages 373 and 375.

Generally speaking, everything is done not only to prevent vitiation of the air in the room but also to maintain a fresh supply of air. Body linen and bedclothes are changed not only at stated intervals, as is the general practice, but also as often as they are soiled. Permission is never given to dry pieces of bandage, towels, or other things in the sick rooms. Neither may we permit the floors of the rooms to be sanded; although sand covers dirty spots, it by no means gets rid of them. The physician must make sure that the commodes for use at night (with which, moreover, only those gravely ill are to be provided) are removed from the rooms immediately after use, that every patient receives a sputum cup (quispedor) of his own, and that the swabs used by attendants to scrub the floor are never very wet. If the weather permits, the windows of the rooms are regularly kept open early and in the afternoon for several hours. Every month we must make it an invariable practice to let each room in turn stand empty for from two to three days, by shifting the patients. The advantage of doing so is that no one room is occupied for too long a stretch, and that every room can be cleaned from top to bottom often enough. Immediately after such an evacuation all utensils (as well as all doors and windows) must be washed off and allowed to dry out of doors; the floors must be scoured with hot lye; the rooms must be kept wide open at least during the first twenty-four hours, and then thoroughly fumigated for several nights with muriatic vapors while the doors and windows are kept shut, and during the day they must be aired again sufficiently. Before the transferred patients return to their rooms, we must provide them with clean underwear as well as completely fresh beds; so that the clean room will not be refilled right away with infected objects.

The measures listed are unusually helpful in preventing the sick rooms from being pervaded with the sickish-sweet odor which always denotes an atmosphere overladen with animal vapors, increasing the virulence of the principle of contagion (432).

Article 188.

δ) In order to prevent spreading of the virus of trachoma, the same measures taken against contagion in every hospital to be converted into a hospital for contagious diseases, in general, must be taken in military hospitals for eye patients (433). I shall not discuss this point, which is a matter of common knowledge. Here I shall confine myself to a detailed account of the preventive measures which are more important for this purpose when convalescents are discharged from hospitals; up to the present these measures have not been sufficiently appreciated.

All patients cured of logado-blennorrhea are bathed in rooms set aside for that very purpose, and are washed from head to foot with a weak solution of caustic alkali, before being discharged (434). While the caustic alkali is applied to the scalp and to the skin of the face, the eyes must be shut tight (to escape injury

(432) See Article 71.

(433) See C. F. Graefe's "Vorläufige hohen Orts genehmigte Instruction für die ärztlichen Dirigenten und Oeconomiebeamten der Militär-Lazarethe", l. c page 15.

(434) See G. A. Richter, l. c., page 211.

from the lye salts) and not opened until [the lids are] thoroughly dry again.

After the bath, convalescents receive disinfected clothing and weapons. Brand-new clothing and arms are not always necessary for this purpose. Although many physicians would have all possessions of trachoma patients consigned to the flames, this is in order only in very rare cases where the agent of contagion becomes unusually virulent (435). When the principle of contagion is not very virulent, such wholesale and, on the whole, often impracticable destruction appears suferfluous. In the latter circumstances we achieve our purpose simply by having all objects used by the soldier carefully aired and cleansed (by exposing such objects to the very hot air in an oven, or to the heaviest frost in the winter, and then by treating them with substances guaranteed to be bactericidal), before the soldier is discharged. To achieve this, objects not classed as weapons (such as linen articles, clothing, et cetera), when very largely freed from the virus of contagion through being well aired and exposed to extremes of heat or cold, are fumigated in hermetically sealed and properly heated rooms for about twenty-four hours continuously with strong nitrate vapors (436). During the last campaigns, on several occasions there was clear proof that even woolen goods is completely freed from the virulent agent of typhus (437). Complete disinfection of weapons (whose usefulness would, more-over, be destroyed by acid vapors) requires merely that after general cleansing and airing, they be washed with a solution of caustic potash, because their material (metal, wood, and burnished glossy leather) is far less receptive to the virus than wool is. When men cured of trachoma have been cleaned as described and furnished with aseptic clothing and weapons, before they return to the army they are next transferred to convalescent divisions (organized especially for this purpose), for reasons which I shall explain later (438).

Chapter III. How to check the Egyptian ophthalmia early enough to ensure its destruction.

Article 189.

Here we must exert ourselves to be on the watch for the anomaly even during its mildest stages, and to remove every victim of trachoma from all harmful influences as soon as possible.

The first requirement calls for thorough examination of persons complaining of eye trouble, and, once logado-blennorrhea becomes widespread, careful supervision even of those persons who consider themselves still unaffected. Accordingly, the main point of the special examination is to find out whether the latent structural anomaly of watering, which has been described in detail earlier and which easily escapes detection in a superficial examination, is present (439). When trachoma is a frequent occurrence, health inspections must be carried out in every company at least once a week.

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(435) See C. F. Graefe's "Vorläufige hohen Orts genehmigte Instruction für die ärztlishen Dirigenten und Oeconomiebeamten der Militär-Lazarethe", l. ., page 15.

(436) See the directions for the establishment of fumigation rooms, in my above-mentioned "Vorlaufige hohn Orts genehmigte Instruction dur die arztlichen Dirigenten und Oeconomiebeamten der Militar-Lazarethe", l. c., page 15 and supplement M.
These directions are quoted word for word by Augustin, l. c., volume 2, pages 373 and 414-415.
See also G. A. Richter, l. c., page 211.

(437) See G. A. Richter, l. c., pages 209 and 263.

(438) See Article 192.

(439) See Article 4.

The second requirement mentioned above is met by sparing (in the manner already recommended elsewhere) all men on the sick list (440) and, in accordance with the principles laid down in Article 183, by sending them to well regulated hospitals at an early date.

I saw this advice bear fruit in the war after my urgent request to all army commanders ("that soldiers declared to have trachoma should be transferred to the nearest military hospital without delay") was increasingly complied with. It was repeatedly confirmed when almost every soldier presenting the milder form of the disease obtained, from that time on, not only speedy but also complete relief (441), thanks to hospital care.

Chapter IV. Prevention of recurrences.

Article 190.

Most soldiers lost their sight less from the first attack than from the repeated recurrence of logado-blennorrhea. Prevention of recurrences is accordingly to be regarded as an extremely important prophylactic measure. To circumvent recurrences in every way, three things must be done: first, all soldiers so constituted that prevention of recurrences on active service is impossible must be given full discharge from the active army; secondly, convalescents must never be sent back to the army too soon; and thirdly, all possible care must be taken to protect those cured against the hardships of a soldier's life.

Article 191.

a) Those to be exempted altogether from service at the front are all men perpetually rendered very susceptible to trachoma (444) by systemic dyscrasias (442) or by incurable sequelae of trachoma (443). Such men spend most of their time in military hospitals exclusively and injure the army by weakening its force, thereby losing (to no purpose) what little sight remained to them. We help both these patients and the army by sending these men with poor constitutions home early; when they do not overdo, their sense of sight often lasts as long as life. All means of subsistence formerly required by these patients can be turned over to able-bodied, capable fighters.

Article 192.

b) Convalescents are never allowed to return to the regiment before they are fully equal to life at the front. During convalescence the eye still appears very sensitive all the time, although the essential symptoms of blennorrhea and its sequelae have disappeared altogether (445). So long as this condition (due chiefly to weakness) persists, any such individual is so susceptible to the untoward influences of military service that, when exposed to them, he is very likely to suffer a recurrence of the primary disease. By creating special divisions for convalescents we now seek to restore to soldiers cured of logado-blennorrhea (when safely removed from all harmful influences) good general health as well as good eyesight, and also to check fresh outbreaks of contagion most assiduously.

(440) See Article 180.
(441) See Articles 160-164.
(442) See Articles 145, 161-164.
(443) See Articles 26-52.
(444) See Article 177.
(445) See Article 91.

The first preventive measure calls for several things: protection of all members of those convalescent divisions against damp air, dust, catching cold, indigestion, intoxication, exhaustion, glare, and eye strain; increasing the men's resistance through a free and easy but yet orderly existence, by means of regular exercise out of doors, easy physical labor, and drill befitting their condition; and making their eyes sufficiently strong through cold ablutions (446), and also through daily instillations of collyria containing lapis divinus [aluminated copper] or zinc sulphate (447). How soon convalescents are thus restored to health is determined mainly by the severity of the previous sickness. A man who has had merely watering can often bear arms again even within a few weeks after the watering has stopped. After the discharge of mucus, permission to resume arms usually comes later. Those cured of severe discharge of pus sometimes take several months to recover completely.

The second preventive measure listed above (the prevention of fresh infection) calls for complete sequestration of all cured men from trachoma patients by resorting either to barracks or to billeting, depending on the circumstances. When dealing with a large number of convalescents, if serviceable buildings suitable for isolation of soldiers are available and are far enough away from the hospitals, well regulated garrisoning is preferable, because convalescents are thus kept under strict medical and military supervision. If no suitable premises are available, or if only a few of a small group of patients are cured and require lodging, we billet them individually in private homes far enough away from the hospitals. The latter form of isolation must in every respect conform with my regulations for the socalled "billeting" hospitals in the cases where, after unexpected conflicts, it was impossible to provide fully equipped "garrisoning" hospitals immediately for the total number of wounded men (448). I hardly need recall that it is also necessary to make a daily examination of all individuals who belong to either type of convalescent division, in order to send any suspicious case back to the hospital immediately.

Article 193.

c) Measures to protect cured men after their return to the army deserve the following comments.

When trachoma has cleared up but is followed by severe and quite frequent congestion of blood toward brain and eye as the result of constipation, the soldier must avoid filling himself with rich starchy foods; he must select instead, so far as circumstances permit, food which is easy to digest, cooked until rather liquid, and aperient. If this does not suffice to stop the constipation, it becomes indispensable to increase peristalsis by administering mild laxatives. Aloe pills (as discussed in Article 282) are good for this simply because they can readily be carried by the soldier on his person. Depending on the effectiveness of the pills, I have soldiers take one to three of them daily for several weeks. Louis Frank

(446) See Article 181.
See the German translation of the English text of Vetch, l. c., pages 15 and 80-81.
See Günther, l. c., page 40.

(447) See Articles 289-290.

(448) See C. F. Graefe's "Vorläufige hohen Orts genehmigte Instruction für die ärztlichen Dirigenten und Oeconomiebeamten der Militair-Lazarethe", l. c., page 15, Article 11, and supplement L.
These directions are quoted by Ribbentrop ("Sammlung", l. c., page 369), and by Augustin (l. c., volume 2, page 388).

likewise states that he has found aloe preparations very successful in combating constipation (449). If the advice given here is not heeded, while congestion increases logado-blennorrhea, too soon recurs.

Every cured soldier must be provided with a suitable pair of protective goggles. Ordinary blinkers formed by attaching horn-rimmed green lenses to a piece of leather proved to be undesirable. Such shades are harmful (450) partly because they irritate the eye severely (owing to the animal vapor which collects under them), and partly because they make the eyes hot (since the body heat finds almost no escape when the lenses keep out the air).

When I had become firmly convinced of this after several trials, I had special frames made; a detailed description of them will be found in Book Six (451). These frames differ from others in that pieces of gauze are inserted in the leather portion and held fast by light-weight metal rings; the gauze can be changed or even added to as required. Such devices keep out ordinary dust, strong wind, and excessive glare without allowing animal vapors to collect, without depriving the wearer of salutary ventilation, or without obstructing the necessary escapt of the body heat. Although they undoubtedly do not offer complete protection against dust and wind, complete protection is generally impracticable, since the eyes, as I pointed out earlier, always suffer when hermetically sealed. Gauze goggles are at the same time all the less unsuitable because diseases result by no means from milder harmful influences but only from more severe ones. I prefer black gauze to green gauze for this purpose because black admits less light without making objects appear dirty-colored, and consequently also disgusting, to the eye, as green gauze does.

Moreover, that gauze shades proved their worth in common use is shown not only by recent reports but also by several older, sufficiently well known observations. Long ago Xenophon, during the famous retreat of the ten thousand Greeks across the Euphrates, sought to protect his army against eye complaints by having the soldiers hang something black (or, in the broader sense of the word μέλας , something dark in color) in front of their eyes on the march. The inhabitants of the far north, when travelling, escape the damaging effects (soon leading to eye trouble) of the very strong light reflected from endless expanses of snow only by properly covering their eyes with some transparent cloth (453). We are told that the Kalmucks almost always cover their eyes with what they call a "Sarabtachi" (a grooved strainer made of horse-hair), in order to protect themselves as much as possible against the injurious glare of the yellowish steppes gleaming brightly in the sun (454).

If cured men again complain of increased ocular sensitiveness after their return to the army, they will be well advised to make constant use of remedies which decrease the sensitiveness of the eye and increase its vigor. For this it is preferable to resort to weak solutions of metallic salts tempered with some opium, as

(449) See the German translation of the French text of Frank, l. c., page 76.

(450) See Assalini, l. c., pages 131-132.

(451) See Article 279 and figure six of table five.

(452) See Xenophon, l. c., page 139, for the following passage:
Ἦν δὲ τοῖς μὲν ὀφθαλμοῖς ἐπικούρημα τῆς χιόνος εἴ τις μέλαν
τι ἔχων πρὸ τῶν ὀφθαλμῶν ἐπορεύετο.
[The eyes were protected from the snow if they were covered with something black by the men while marching].

(453) See the German translation of the French translation of the English text of Monro, l. c., volume 1, page 57.

(454) See Pallas, l. c., volume 1, page 243.

prescribed by us during the stage of convalescence proper (455). Several other physicians as well as myself became convinced of their good effects in these circumstances (456). Generally speaking, men with delicate constitutions responded better to lapis divinus [aluminated copper], while men with rugged health responded better to zinc sulphate. It is not necessary for a soldier to carry more than a small half-ounce bottle of those collyria with him, As to administration of the eyewash, one comrade soon learns to help his fellow comrades. While troops are on the march, these solutions must always be instilled just once a day, and then only before going to sleep; if they are used too often, and if the eye is exposed to strong light immediately after the drops have been put in, there are sometimes very dire consequences.

Lastly, all cured men who have returned to their regiments, no matter how well their eyes feel, must nevertheless bathe their eyelids two or three times a day with cool, pure, fresh-drawn well water. Exceptions to this practice must be made in the case of those few persons, most of them arthritic, who in general cannot tolerate the application of any moisture to the skin of the face (456). The value of this practice found ample confirmation during the war. Scarpa recommends this as a particularly effective means of preventing recurrences of the Egyptian ophthalmia (457). In what way such ablutions have healing virtues I pointed out earlier, in discussing how individuals who have never had trachoma before may protect themselves against trachoma when afield (458).

Part three. Treatment of logado-blennorrhea.

Article 194.

Before we examine the medical steps taken to counteract trachoma, it is interesting to glance at the commonest folk remedies ordinarily used for this disease.

The average native of Egypt believes it possible to cure logado-blennorrhea by painting white, black, and yellow rings around any eye so affected, by eating very sparingly, and by continually sitting still in the shade (459). The blacks consider a mixture containing four parts of water, one part of lemon juice, one part of coffee, and two parts of arrack, when faithfully applied to the affected part, as the best medicine (460). Undoubtedly both methods of treatment can do some good in that they ensure rest, cooling, and protection of the eye against external injuries; nevertheless, as a rule, this procedure alone falls far short of affording trachoma patients sufficient protection in all circumstances.

It is at once evident that the procedures found successful to date by physicians leave a great deal to be desired, in that diametrically opposed prescriptions are recommended with the same degree of confidence. Thus many experts maintain that only drugs taken internally are beneficial. Hence a few recommend narcotic collyria, while several expect good results from astringent and stimulating fomentations alone. For this reason estimable observers assert that all untoward sequelae of logado-blennorrhea are due solely to the neglect of bloodletting; the counterclaim of medical leaders no whit inferior is that trachoma never appears malignant save when patients are excessively weakened by venesection. Thus on the one hand, we see emetica and laxantia prescribed exclusively, and on the other hand again we see audorifera and roborantia prescribed exclusively (461). -

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(455) See Article 193.

(456) See Article 181.

(457) See the letter by Scarpa in Nuovi Commentari di medicina, Padua, volume 1, semestr, I, pages 204-211, number 5, March 1, 1818. (Especially 206).

(458) See Article 181.

(459) The Egyptians prepare the black paint from antimony, gallnuts, and vinegar, the white paint from white lead and water, and the yellow paint from saffrom powder, white lead, and vinegar.
See Assalini, l. c., pages 124 and 129.

(460) See Macgregor, quoted by Omodei, l. c., page 152.

My wide experience is based on a large number of trachoma patients under my immediate supervision, and on all trachoma patients who were given the most widely varying remedies by different health officers. Consequently I am convinced that there can be no doubt on four points: 1- the inadequacy of the usual treatment is to be ascribed chiefly to too limited a conception of the nature of the disease; 2- for that very reason many physicians are right in a particular instance but wrong as regards the subject as a whole; 3- for the same reason, no suggestion advanced is to be disregarded altogether, but neither can any such suggestion be given preference; and 4- we are sure of attaining the purpose of the treatment only when we do not cling to hard and fast modes of treatment, but in every instance make it a point to suit the therapy to the individual requirements. Now, in order to survey the question of how trachoma is to be wiped out in accordance with the principles listed, I shall devote the next sections to a detailed account of: first, socalled causal treatment; secondly, treatment determined by the clinical picture; thirdly, treatment according to the stages of development; and fourthly, treatment of the sequelae in question.

Section one. Treatment based on cause.

Article 195.

If we do not make it a point to treat the causes of trachoma, any direct attack on the disease remains more or less fruitless. It is therefore indispensable that the etiologic treatment should most carefully be kept in mind at all times. In order to obtain a clear account of this, we must first study how general influences harmful to all victims are removed, and then study how special etiologic factors affecting only a few individuals are to be removed.

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(461) See Hippocrates, "Opera omnia", l. c., Sect. V, page 698.
See Galen, l. c., volume 7, Lib. IV, pages 104 and 177.
See Celsus, l. c., pages 288 and 301.
See Alpini, l. c., page 66.
See Boerhaave, l. c., page 43.
See Chamseru, l. c.
See the book by Larrey, l. c., volume 1, pages 210-218.
See Bruant, l. c.
See Assalini, l. c., pages 118-132.
See the German translation of the English text of Vetch, l. c., pages 52-81.
See Farrel, quoted by Omodei, l. c., pages 129, 135, 137, and 141.
See Macgregor, quoted by Omodei, l. c., pages 152-154.
See Saunders, quoted by Vasani, l. c., page 81.
See Bongiovanni, Marescotti, and Penada, quoted by Omodei, l. c., pages 121-122.
See Scarpa, quoted by Vasani, l. c., page 70.
See Omodei, l. c., pages 109-158.
See Vasani, l. c., pages 60-92.
See the German translation of the French text of Frank, l. c., pages 83-153 et seq.
See Baltz, l. c., pages 51-89.
See Rust, l. c., page 193.
See Kluyskens, l. c., pages 57 et seq.
See Ziermann, l. c., pages 204 et seq.
See Fischer;s thesis, l. c., pages 21-28.
See Lehmann, l. c., pages 23-44. See Helling, l. c., pages 45-69.

Chapter I. Treatment directed against general causes.

a) Its application in military service in the open.

Article 196.

Although the treatment of trachoma patients is essentially the same (462) whether causal or of any other type, whether applied under cover or in the open, there are certain aspects to be given special consideration when combating the causes out of doors; these aspects are the only ones concerned here. They include both preventive measures which are helpful in hospitals but are harmful outside of hospitals, and certain measures which are of special benefit in removing harmful influences from purely out-patient cases. -

Poultices which remain moist for a long time, fatty ointments, and sudorific drugs belong to the first class. In individuals who are exposed to the elements those fomentations very soon produce erysipelas of the lids, owing to excessively rapid evaporation and consequently to frequent changes in temperature. Ointments enable dust to collect and they cause harmful irritation in these circumstances by readily getting in the eye, even if only their external use is indicated. Diaphoretica which are suitable for catarrhal eye patients in a hospital (such as elder-flower tea, solutions of ammonium acetate, and antimonials) never cause improvement but often make matters worse, owing to unavoidable cooling naturally attending camp life (463). -

Our experience shows that the measures most helpful in curing the causes of the disease under the open sky are principally the shielding of the eyes, and the avoidance of hard labor accelerating the circulation. The sore eyes should be covered with soft linen compresses which, by means of a bandage encircling the head, are fastened to the forehead in such a way that they hang down over each eye as far as the cheeks, without causing annoyance from pressure or from an accumulation of heat. I often encountered cases where the sore eyes were protected by rough, dirty, thick handkerchiefs or cravats, by woolen nightcaps and so forth pulled far down; such procedures, owing to pressure and lack of cleanliness, are more harmful than when the eyes are exposed to the full force of light and air. The only thing that we can do to mitigate physical strain in the active army is to furnish enough transport wagons for trachoma patients. Trachoma made much slower progress in all men allowed to ride than in men who followed their regiments on foot. -

If we look back at the explanations advanced, at the many evils not remedied out of doors (464), and at the great dearth of remedies efficacious in these circumstances (465), two things are evident. As a rule, we cannot transfer trachoma patients to properly equipped hospitals any too soon. Hospitalization is almost obligatory when the weather is dusty, damp, cold, and very changeable, or when patients are slow in responding well to whatever treatment the army can give them (466).

(462) See Articles 198-245.
(463) See Article 212.
(464) See Articles 134-159.
(465) See Articles 198-245.
(466) See Articles 162-164.

b) Its application in hospitals.

Article 197.

aa) Sick-room regulations.

The right kind of hospital room can offer protection against serious harmful influences and in that way do a very great deal to make recovery more certain. In this connection let us pay special attention to what follows. -

All rooms set aside for trachoma patients must be located far from toilets, stables, sewers, and ditches, so that the air admitted is not vitiated (467) but pure, healthy, and fresh. -

It is by no means permissible to paint the walls a dazzling white; white surfaces usually reflect light too much. The best color of paint ot use is one refracting light, a pleasing green, light blue, or light gray (468). Where the hospitals are much in use the rooms must be freshly painted at least once a year. -

For the sake of sanitation, to keep out smoke, to prevent patients from having control over the wood supply, and to render secret cooking in the rooms impossible, stoves must always be exclusively of the kind heated from the outside (469). -

It is best to so arrange it that the lamp in the room hangs from the middle of the ceiling, partly to prevent the oil from spilling, and partly to have the light evenly distributed to each part of the room. It is a good idea to equip the lamps with green chimneys made of tin, so that the flame can be left uncovered and, if desirable, covered in part or in toto. A long time ago I introduced such lamps into the eye-surgery station of the Berlin clinic, and made good use of their tin chimneys to supplement the ventilators. -

Each window is to be equipped with two roller-blinds, one made of flannel dyed black, the other made of light gray linen. Both are used simultaneously when complete darkness is desired; the linen one is used alone to soften the light. The ordinary roller-blinds, which can be let down only from the upper part of the window, are inferior to blinds which can likewise be fastened to the lower part of the window and drawn upward from it as desired. The latter mechanism permits the light to be admitted more gradually in proportion as we leave the uppermost part of the window clear at first and only later leave the lower part unobstructed. Great care must be taken here to have the edges of the roller-blinds fit behind projecting moulding at all points. If this adjustment is not made, streaks of light appear, sometimes at the sides, sometimes at the top or bottom; they are all the more harmful as they are more blinding in the darkened room (470). Such window shades have proven of worth for several years in the eye-surgery station of the Berlin clinic.

All other essential sick-room regulations have already been fully discussed in connection with the list of rules for preventing the spread of contagion (471).

Article 198.

bb) Use of eyeshades.

(467) See Article 147.
(468) See Article 136.
(469) See Article 136.
(470) See the general account of glare in Article 136.
(471) See Articles 184-188.

Every eye patient receives a fresh eyeshade modelled on the one described in Article 278. We can dispense with such devices only while the rooms are kept perfectly dark for cases of severe photophobia, or while the eyelids almost meet during the fastigium as the result of enormous swelling and secretion (472). With these exceptions, trachoma patients must wear this shade constantly, so that no harmful glare may reach their eyes either indoors or outdoors.

Article 199.

cc) Head covering of eye patients.

Very warm head coverings never fail to cause harm in logado-blennorrhea because they promote congestion toward the brain (473). The use of thick nightcaps, of woolen forage caps, and of large kerchiefs would around the forehead and temples is positively forbidden. The patient should wear nothing else upon his head, ordinarily, but his eyeshade and the ocular bandage which he finds somewhat necessary (474). We allow light-weight linen nightcaps to be worn only those persons who have become so accustomed to them that they always find it painful to go bareheaded for long.

Article 200.

dd) Footwear of trachoma patients.

By keeping the feet warm the blood stream is drawn off from the eye (475); hence in trachoma the feet must be kept as warm as possible. Bedridden men whose feet readily become chilled by becoming uncovered during sleep, or when the men get up to go to the toilet, must therefore be made to wear stockings all the time. For the same reason we must provide warm socks and whole shoes for all those patients well enough to live outside the sick room(476).

Article 201.

ee) Regulations as to outdoor exercise.

Wide experience teaches that apyretic men suffering from the milder and torpid form of ocular blennorrhea take longer to recover when confined to their rooms, but get well faster when they take a stroll outdoors from time to time. However undeniable this fact is, I became just as much convinced that keeping out of doors is of genuine value only when the patients do not go outside the hospital early in the morning, late in the evening, or when the weather is dusty, stormy, damp, freezing, or hot. To prevent breaking of any of these rules, trachoma patients allowed outdoor exercise by their physician must never go outdoors except at stated hours, and unless accompanied by a comrade placed in charge of them (477). This supervision is necessary because otherwise soldiers are very apt to go astray, with the result that, sooner or later, both their general health and their eyes suffer.

(472) See the illustration of this in table two.
See Article 22.
(473) See Articles 137, 178.
(474) See Articles 196-199.
(475) See Articles 154, 179.
(476) See Article 179.
(477) See C. F. Graefe's "Vorlaufige hohen Orts genehmigte Instruction fur die arztlichen Dirigenten und Oeconomiebeamten der Militar-Lazarethe", l. c., page 12, Article 9.
See Augustin, l. c., volume 2, pages 273 and 275.

Article 202.

ff) Temperature of the sick room.

One should strive to keep the temperature of the sick room moderate. Room tem- above fourteen degrees Réaumur in winter are harmful to all eye patients, but above all to those afflicted with trachoma; such heat promotes congestions toward the head, increases the number of fever attacks, irritates the eyeball, and leads to ocular hypersecretion. On several occasions I noted an immediate decrease in the pathologic symptoms in many persons when the temperature of the room was lowered.

Article 203.

gg) General rules regarding diet.

In addition to those dietetic rules which are to be established in accordance with the differences in the form of the disease (478), several general rules must be carefully observed in the nursing of trachoma patients. A light and bland diet is generally of value here(479); it is advisable to include barley, potatoes, groats, grit, soft-cooked eggs, broth, good veal, beef, or mutton, stewed prunes, bread made from sifted flour, rolls, and bitter beer which is not too strong. Rich and highly seasoned food, on the contrary, must be absolutely forbidden. Particularly to be avoided are: the cabbage family and ripe legumes; furthermore, all salted, pickled, smoked, very fat food containing lard or oil; and also all kinds of cheese. These foodstuffs, particularly because there is always sympathetic abdominal reaction in logado-blennorrhea, not only leave the body slowly but also are incompletely assimilated (480). In that way they work harm either through facilitated congestion of blood toward the head (481), or through the formation of anomalous lymph (482). Anyone who finds fault with the rules listed, which were held in esteem even by the physicians of antiquity (483), has poor powers of observation. I myself owe many very favorable results to the observance of these rules.

Article 204.

hh) Ridding the eyes of the blennorrheal secretion.

In trachoma it is necessary to keep not only the eyes but also the adjacent parts as free as possible from the discharge at all times. If we neglect to do so, the secretion is very apt to run down the cheeks and lead to inflammations of the facial skin, to solidify as crusts upon the lashes and lead to irritations of the eyeball, and to accumulate under the lids and lead to more rapid spreading of the disease (484).

In the mild form of the disease, if the palpebral aperture is closed merely because the cilia are stuck together, it suffices to cover the eyelids every morning with lukewarm poultices of pure water, milk, marshmallow decoctions, or linseed

(478) See Articles 219, 223, 227.
(479) See Articles 86, 143.
(480) See Article 86.
(481) See Article 137.
(482) See Articles 142-145.
(483) See Hippocrates, "Opera omnia", l. c., Sect. VII, page 1155.
See Galen, l. c., volume 2, Lib. I, chapters 23-30.
See Celsus, l. c., book 3, chapters 10 and 16, page 288.
(484) See Articles 3, 9, 14, 22, 61-62.

decoctions, and then to cleanse them gently with soft small sponges which are fairly moist. If small bits of crust remain in spite of this, we must remove them cautiously with a probe inserted between the cilia. Whichever method is used, one must of course guard against giving pain, tearing out cilia, or allowing dried particles of pus to get under the lids.

If, as the result of marked edema associated with purulent secretion, the tarsal edges are so agglutinated that large conjunctival swellings appear at every attempt to expose part of the eyeball, we cautiously spread the lids only a line apart when all crusts have been removed by artificial means. The rest is evacuated by dropping some distilled water in the palpebral aperture with a small sponge. We do not find it necessary to repeat this cleansing procedure more than two or three times a day. I cannot recommend injections under the eyelids for this pathologic condition because, when the tarsal edges are stuck fast together, the cannula to be inserted always comes into contact with the eyeball; severe reactions are inevitably caused in this way.

If, during the fastigium of trachoma, the upper lid droops clear over the lower lid(485), and if the palpebral aperture cannot be opened at all in the middle, the physician must first cleanse the outside in the prescribed manner and then make the pus trickle forth by carefully exposing the inner canthus to the air, and complete the evacuation (which is difficult in these circumstances) by injections of tepid distilled water. The reason why injections are safe in marked palpebral drooping is because here the stream of water does not strike the eyeball, and the cannula does not touch the eyeball in any way but is merely placed between the internal wall of the upper lid and the outer wall of the lower lid.

In the presence of eversions we select the former method of cleansing on some occasions, and the latter one on other occasions: we select the former when there is agglutination of two granulations, and the latter when ectropion makes one lid practically cover the other(486).

Immediately after every cleansing, the skin of the lids and cheeks is carefully wiped off with a warm compress or a soft wad of lint. Failure to do so causes mild erysipelatous edema of the lids from the evaporation of the water, at least if moist applications are fairly frequent.

The directions which I have already given (in connection with the isolation of every single patient) explain how to carry out the cleansing so that it will not spread contagion (487).

In order to make sure that there will be no painful chafing of the cheeks from very acrid and corrosive discharges, we have a very thin coating of lead-tetroxide ointment smeared over the cheeks once or twice a day (488).

Chapter II. Treatment directed against special causes.

a) How to counteract congestions of blood toward the head.

Article 205.

It is always of great importance to direct treatment against congestions toward

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(485) See the illustration in table two.
See Articles 18-22.
(486) See the illustrations in tables three and four.
See Articles 19, 27.
(487) See Article 185.
(488) See Article 299.

the grain in trachoma, since they promote ocular secretion (489). Not all prescriptions recommended for the arrest of this particularly pure type of congestion can be used indiscriminately to counteract congestion that accompanies logado-blennorrhea (490). This statement applies particularly to topica which act more or less as repulsives, and which likewise include cold poultices in particular; as a whole they are harmful here once the discharge has become a truly serious matter (491); and they can be of service only when the discharge has definitely not become the serious affair just mentioned(492). Moreover, the selection of methods of procedure generally used to counteract congestion depends chiefly on the degree of congestion accompanying trachoma (493). I shall devote the next articles to certain measures selected from the group of reliable means of arresting congestion. I shall discuss first the milder measures adapted to the initial stages of congestion, and then the more drastic measures which enable us to combat the advanced stages of congestion.

Article 206.

aa) Treatment of mild contagion.

The following instructions must be carried out in mild congestion closely bound up with logado-blennorrhea (494). We recommend that all patients keep the upper half of their bodies erect rather than recumbent. That is why every victim should be sitting up for the most part and never stretched out flat when resting in bed. Unless contraindicated by the rest of the patient's condition, a moderate amount of getting out of bed is, for the reason just mentioned, deservedly preferable to remaining in bed all the time. -

Furthermore, the patient's head must always be kept cool. Here let me add one rule to the general rules concerning this subject already listed elsewhere (495). Ordinary pillows stuffed with feathers are to be replaced by head supports stuffed with horsehair, chopped straw, or dry moss. The former promote heat to a harmful extent; the latter, if the stuffing is put in loosely, are sure to prove soft enough for even more pampered patients to lie on. -

Even patients afflicted with mild congestion must not fail to have their bowels move daily. Where there is no natural movement, the bowels must be aided by means of cream of tartar, sodium sulphate, or magnesia plus a little tartaric acid. -

Foot-baths which are strictly lukewarm afford much relief. Frank recommends that they be used regularly every day because of the great benefit that he saw de-

(489) See Article 83.
See the book by C. F. Graefe, "Angiectasie", l. c., pages 31-33, 45-46, and 56-58.
See the book by J. C. Reil, "Ueber die Erkenntniss und Kur der Fieber", l. c., volume 3, pages 1 et seq.

(490) See the book by J. C. Reil, "Ueber die Erkenntniss und Kur der Fieber", l. c., volume 3, pages 18 et seq.

(491) See Article 230.

(492) See Article 230.

(493) See Article 83.

(494) See Article 83.

(495) See Articles 178, 187, 196, 199.
See the book by C. F. Graefe, "Angiectasie", l. c., page 60.

rived from them (496). -

Lastly, the regulations listed must be further supported by having every patient carefully avoid all causes of congestion already mentioned (497).

Article 207.

bb) Treatment of severe congestion.

In combating advanced stages of congestion, appearing more independently during the course of logado-blennorrhea (498), we have recourse to measures more drastic than the ones noted in the preceding article. -

In these circumstances bloodletting is absolutely necessary. If venesection is very helpful but severe congestion returns in a few hours or days, we must boldly repeat the venesection; thus it is sometimes necessary to do so three, four, or five times in succession (499). The application of leeches to the forehead, to the temples, behind both ears, or to the nape of the neck following venesection affords considerable relief. Where hemorrhoids were likewise present, leeches, when applied to the anus in sufficient numbers, gave particularly good results. -

Laxatives are beneficial here, in that they draw the blood to the abdomen. Although purely inflammatory drastic purgatives, such as gamboge and colocynth, are recommended without reserve by some physicians (500), I have never seen the boasted good effects; they caused griping and severe general congestion without being sufficiently aperient, for the most part. Pills made of sapo jalapinus and a little calomel proved better able to bring on diarrhea lasting several days. I found that the best way to end constipation without any harmful secondary effects was to use the mixture whose prescription constitutes Article 281. As soon as both the congestion and the constipation abate, we return from the purgatives just recommended to the milder ones mentioned earlier (501). Aperient treatment can usually be kept up here over a long period without telling on the digestive system; however, if relaxation of the intestinal canal does appear sooner or later, the physician must depart from the beaten path, for otherwise gastric troubles which are per se harmful to the eye are produced (502). Among the older writers who recommend laxatives for this complication, Hippocrates, Galen, Celsus, Prospero Alpini, and Aetius of Amida deserve special mention (503). In our own time purgatives were recommended chiefly by Brigges, Vetch, Bongiovanni, Marescotti, Vasani, Frölich, and Hellström (504). -

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(496) See the German translation of the French text of Frank, l. c., page 77.
(497) See Articles 83, 137.
(498) See Article 83.
(499) See Article 217.
(500) See the German translation of the English text of Vetch, l. c., page 58.
See Vasani, l. c., pages 82-83.
(501) See Article 206.
(502) See Article 86.
(503) See Hippocrates, "Opera omnia", l. c., Sect. V, page 689.
See Galen, l. c., volume 7, pages 104 and 177.
See Celsus, l. c., book 7, chapter 9.
See Alpini, l. c., page 46b.
(504) See the German translation of the English text of Vetch, l. c., page 58.
See Omodei, l. c., pages 121-122 and 155.
See Vasani, l. c., pages 82-83.
See Frölich and Hellström, l. c., page 132.

Inorganic acids are useful in congestions when the vascular system, after sufficient recourse to bloodletting and purgatives, still shows a constant tendency toward over-activity. Both sulphuric acid and phosphoric acid, when mixed with a drink, were very well tolerated by trachoma patients. -

We administer narcotics where the vascular anomaly proceeds merely from pathologically increased sensitiveness in general, and particularly after the use of the means listed so far (505). My own choice falls on opium. Although many fear that its properties will increase vascular activity, this need never be feared if enough blood has been drawn off and defecations have become regular, and if there is no longer any condition requiring the use of acids. In every instance where opium is not forbidden either by reason of these conditions or on account of special idiosyncrasy, it can be relied on to help more than all other similar drugs can. It cannot be used over a long period, however, owing to its constipating properties. If we are obliged to abandon opium, it is to be replaced by henbane [Hyoscyamus niger] , purple foxglove [Digitalis purpurea] , or cherry laurel water [aqua laurocerasi] . Cherry laurol oil [oleum laurocerasi] , whose formula constitutes Article 286, was especially beneficial to certain patients. Since congestion accompanying trachoma almost always grows worse during the night, parogoric administered shortly before bedtime usually proves to be most helpful. Moreover, as I hardly need say, here all remote causes responsible for congestions toward the head are to be combated with even more concentration than in the initial stages of congestion (506).

Article 208.

b) Treatment of the abdominal complications of logado-blennorrhea.

In this treatment special attention must be paid to whether the abdominal disorders are sympathetic or idiopathic in origin (507). -

If their origin is sympathetic (if bilious attacks, nausea, and indigestion supervene immediately after the appearance of severe pains in the eye and forehead, where no other causes are involved), drugs acting directly on the digestive system do more harm than good. In these circumstances the best way to treat the abdominal complication is to employ, at the outset, treatment suitable to the form (508) and degree of development of trachoma (509). So long as the abatement of the ocular pains and headache is accompanied by a corresponding mitigation of the gastric complication, those remedies are continued; the latter enable us to put an end to the abdominal disturbance wherever it has not begun to make progress at the time. It is necessary to act directly on the intestinal canal at the same time only in the case where abdominal disorders of sympathetic origin have already gained some degree of independence, where, for that very reason, they do not subside sufficiently even after proper treatment of trachoma. Emetics composed of tartar emetic and ipecac are best for this purpose. When they have paved the way for improvement and the prescribed diet (510) is being followed, we give small doses of sal ammoniac, tartarus tartarisatus, and rhubarb; and if the digestive organs are merely left weak, we give bitter extracts dissolved in aqua menthae, or extracts of calamus and extracts of Peruvian bark [Cinchona]. -

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(505) See the book by C. F. Graefe, "Angiectasie", l. c., page 55.

(506) See Articles 83, 137, 206.

(507) See Article 86.

(508) See Articles 215-227.

(509) See Articles 228-245.

(510) See Articles 86, 203.

Disorders which belong to the same class but are idiopathic (accompanied by marked turgescence, and usually the result of indigestible food or overloading of the stomach) are treated exclusively with emetics at first (511). Emetics are highly efficacious here not only because they act as alternatives on the intestinal canal but also because they clear it out. As a rule, the use of emetics is immediately followed by an abatement of both the abdominal disturbance and trachoma (512). If this abatement is considerable, emetics are followed first by the same incitants and then by the same roborants which I prescribed for anomalies of sympathetic origin. -

Success can result from the use of emetics only if we administer them in accordance with those prinicples. When employed indiscriminately they often work much harm (513). The suggestion that every form of trachoma is to be treated merely with ordinary emetics is particularly to be condemned (514). When trachoma in the initial stages is checked in this way, it likewise subsides more; emetics have no effect on the advanced stages of trachoma because this class of remedy is powerless against the more serious structural anomalies which always accompany such stages (515).

Article 209.

c) Treatment of hyposecretions.

The severer the trachoma caused by certain suppressions of secretion (516), the more energetic measures must we take to restore the impaired secretion. The following articles explain the measures to be taken to satisfy this requirement as regards all the causes involved here.

Article 210.

aa) Procedure in impaired power of secretion of the intestinal canal.

The article on the treatment of congestion contains the information requisite for the treatment of constipation in patients who have always had perfectly normal bowel movements (517). Consequently the only aspect left to discuss here is what procedure is to be followed by the physician where constipation suddenly affects individuals who for some time have suffered from pathologically increased defecation (518). My own experience indicates that three courses must be collowed in such circumstances. First, serous intestinal secretions must be induced by means of calomel or the potion recommended in Article 281. Next, we must maintain moder-

(511) See Bruant, l. c.
(512) See Article 86.
(513) See the German translation of the English text of Vetch, l. c., page 59. See the letter by Scarpa in Nuovi Commentari di medicina, Padua, volume 1, semestr. I, pages 204-211, number 5, March 1, 1818. (Especially 205).
(514) See Adams, quoted by Günther, l. c., page 45.
(515) See Articles 16-17.
(516) See Articles 149-157.
(517) See Articles 206-207.
(518) See Article 150.

ate diarrhea by means of aperient food (519) - and if necessary by means of adequate doses of cream of tartar, sulphur, and magnesia - until the trachoma has wholly cleared up. Lastly, if the induced diarrhea does not cease spontaneously, we must prescribe cascarilla decoctions with gum arabic [acacia], or, when diarrhea continues very stubbornly, increasing doses of lead acetate with some opium. It is noteworthy that lead acetate (given one to three times a day, in doses up to one grain) not only counteracted such diarrhea which had become colliquative better than the other drugs, but also never reacted harmfully on the system as a whole or on the eyes when used gradually.

Article 211.

bb) Treatment of suppressed gonorrhea.

Where logado-blennorrhea is due to suppressed gonorrhea (520), immediate reestablishment of the urethral disease is urgently necessary. The treatment must be altered according to whether the suppression is connected with active inflammation, or with manifest sluggishness of the urethra.

In the first case, if patients complain of sharp pains along the urethra, of swelling and heat on the part of the penis, and of redness of the meatus urinarius, we have leeches applied to the perineum, we have the patients take lukewarm hipbaths, we have oil of almonds injected into the urethra, we have the men consume a generous amount of gruel, and we have potent general antiphlogistics administered.

In the second case, distinguished by hyposensitiveness of the urethra, the first step in the treatment is to insert oiled catgut bougies. As a rule, we see the flow restored immediately afterwards, within twenty-four hours. If the procedure recommended fails in the case of extremely torpid individuals, we order a slender piece of catgut coated with red-precipitate ointment [unguentum hydrargyri oxidi rubri] to be introduced into the urethra, and tepid cataplasms to be placed around the genitalia simultaneously. In no case did I go so far as to produce gonorrhea by inoculation, since the remedies listed always achieved their purpose.

Moreover, once the anomalous urethral secretion is restored, it must be maintained (by continuing to insert bougies occasionally) until the patient has completely recovered from logado-blennorrhea. Only after the trachoma is a thing of the past can we gradually eradicate the gonorrhea, too. For this purpose, if the gonorrhea does not cease spontaneously after the use of bougies has been discarded, I prescribe moderately strong purgatives composed of jalap root several days a week, and emulsions of balsam of copaiba with cherry laurel water [aqua laurocerasi] on the other days. If the gonorrhea stubbornly resists the drugs just mentioned, we administer either fifteen to twenty drops of liquor saponis stibiati with some barley water four times a day, or about two grains of edulcorated mercury a day. Since Crawford's report, I have also obtained good results with cubeb seeds on several occasions (521). Since ordinary gonorrhea can be cured with the aforementioned methods almost without exception, particular pains must be taken to avoid all remedies whose action is purely local because, even after the eyes have remained well for some time, topica readily produce recurrences of logado-blennorrhea.

Article 212.

cc) Treatment when the secretion of the outer skin is suppressed.

(519) See Articles 86, 150, 203.
(520) See Article 151.
(521) See Crawford, l. c., page 740.

In order to render the skin active (522) in trachoma, we generally resort to the same measures which have proven useful in counteracting catarrhal affections as a whole. Accordingly I shall single out from such remedies merely those which are of outstanding value in the present circumstances. -

In the presence of fever, sal ammoniac promotes perspiration and at the same time reduces the abnormally increased vascular activity (523) in a mild way; it was exceptionally beneficial to those individuals who suffered from catarrhal trachoma accompanied by feverishness. Only second to it in efficacy was ammonium acetate. If the drugs mentioned are slow in producing sufficient perspiration, at bedtime patients are given powdered camphor (524), are made to drink warm elder-flower tea, and are carefully covered up. When even the latter treatment fails to diminish the rigidity of the skin which is the result of earlier, very severe chilling (525), lukewarm baths are most appropriate. When patients perspired freely as early as the second or third bath, I repeatedly saw the trachoma disappear and also recovery hastened in every respect. Celsus and Aetium of Amida, among physicians of antiquity, regard warm baths as exceedingly powerful abortifacients of logado-blennorrhea (526). In recent times Vasani treated trachoma with cold baths (527). It is known that such baths bring back perspiration by speedy derivation of the excessive body heat which has accumulated at the surface, when the skin is dry and burning. It may be that in such conditions Vasani's method promotes the cure of trachoma. But, for fear of the effects of repulsives, I should never follow his advice except when lukewarm baths fail to open the pores of the skin sufficiently.

Article 213.

dd) Treatment of suppressed secretion in secretory organs of anomalous origin.

If rapid healing of suppurating wounds or ulcers appears as the cause of logado-blennorrhea (528), the former suppuration must be re-established with all speed. Different methods must be employed, depending on whether there is merely hyposecretion, or whether the process of secretion has ceased altogether as the result of cicatrization. In the first case, lukewarm cataplasms and cantharidal ointment are regularly kept upon the open sore for several days. In the second case, we irritate the scar by means of some ordinary vesicant, and then we keep up the secretion partly with tepid poultices, partly with strong irritant ointments. Complete healing of those ulcerations is not permissible until the trachoma has cleared up entirely. But at the same time it does no harm to administer purgatives before the scar has fully healed, and to have fontanelles or setons worn for several months in all cases where such conditions are of very long standing.

Article 214.

d) A Consideration of the dyscrasias.

We seek to eradicate acute forms of scrofula, syphilis, arthritis, and psoriasis accompanying trachoma (529) by following the general directions for the treatment of these anomalies. From these directions I shall therefore select for discussion only a few which are of paramount importance as a connecting link in the etiology here.

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(522) See Articles 152-156.
(523) See Article 283.
(524) See Article 284.
(525) See Articles 152-156.
(526) See Celsus, l. c., page 293.
See Aetius of Amida, l. c., Lib. VII, c. 6.
(527) See Vasani, l. c., page 83.
(528) See Articles 88, 157.

Peruvian bark [Cinchona] was almost always indispensable in the radical cure of scrofula and arthritis when the acute stage of trachoma was over. When used in conjunction with Plummer's pills [pilulae antimonii compositae], it was most efficacious in concentrated decoctions mixed with wine. When given as powder combined with Guaiacum, aconite, and oil of cajeput, it was especially beneficial to weakened gouty persons (530).

The majority of syphilitic eye patients were cured with sublimate [mercuric chloride]. I became firmly convinced that this metallic salt had the desired effect only when sufficient amounts of it were ingested along with food. Particularly good results were obtained with the pills whose formula constitutes Article 287, according to which six pills contain one grain of mercury. More delicate patients took three of the pills a day, and more robust patients took six; thus the first third of the dose was taken with breakfast, the second third with the noon meal, and the last third with the evening meal. When the sublimate was taken in this way and the diet was also correct, I never saw the untoward effects which at other times follow its use. -

As for the treatment of scabies in trachoma patients, sulphur taken internally and soap baths at frequent intervals were best. Next came inunctions with ordinary sulphur ointment containing a generous admixture of white precipitate [ammoniated mercury]. It was by no means permissible to use this therapeutic procedure so intensively that it soon put an end to the eruption. Although unctions composed of the famous itch salve (containing an admixture of alkali and white hellebore [Veratrum album]), which is used chiefly by the English, stopped the itching within a short time, they had a bad effect on the eyes for that very reason. Thus I repeatedly noticed how every application of repellentia leads to marked aggravation of logado-blennorrhea or to amaurosis. -

Lastly, during the general treatment care must also be taken to mitigate as much as possible the harmful influence of every dyscrasia on trachomatous eyes, by recourse to powerful derivatives in the form of fontanelles or setons.

Section two. Treatment based on form.

Article 215.

The type of treatment required here is determined by the degree of development of the forms of trachoma (531). The milder forms require no particular treatment; here, if we so apply all the rules listed for the other aspects of the disease that the condition of vegetation mentioned does not grow worse, that is all that we need to do. But in the cases which are manifestly synochal, erethitic, or torpid, we are obliged to take special measures to combat these forms. Indeed, matters are often so very urgent that we have no right to think first of the other indications (e. g., destroying the causes); our sole aim must be to act on the advanced stages reached by the form present before it alone destroys the eye. The following articles show what special steps must now be taken to meet these requirements.

(529) See Articles 87, 145.
(530) See Article 285.
(531) See Articles 75-78.

Chapter I. Treatment of the synochal form of logado-blennorrhea.

Article 216.

We use antiphlogistics to combat the synochal condition of vegetation due to a simultaneous increase in sensitiveness and irritability.

If this form has reached its most advanced stages (532), treatment must be just as speedy as it is bold. This principle always holds good in internal and external treatment, whether synocha is seated in the diseased structure alone or is systemic (533). If this form has not reached its peak (534), we employ somewhat less drastic means; radical means usually do harm, in that they produce a state of debility in which the disease takes an unfavorable turn, as a rule.

In order to afford a survey of all the remedies, both the more powerful and the milder ones, of value in counteracting synochal logado-blennorrhea, I shall divide them into three groups: general remedies, topica, and dietetic remedies proper.

Article 217.

a) Remedies having a general action.

Venesection is indispensable in advanced synochal logado-blennorrhea. Fairly large quantities of blood (twelve, sixteen, twenty ounces) must always be drawn off at one time and within a short time in these circumstances. I was quite often obliged to let six to eight pounds of blood in three days by means of repeated phlebotomy. Here I do not include the blood removed directly from the vicinity of the eye at the same time through the use of twelve leeches two to three times. We bodly repeat venesection so long as it fails to produce lasting improvement in the local attacks of the genuine synochal form. This repetition is necessary even if the improvement lasts but a few hours. If the pulse remains hard, it always means that the patient has not been bled enough. A soft and small pulse contraindicates venesection unless local manifestations of severe synocha continue present. The fact that venesection for trachoma was held in high esteem by the oldest physicians and the fact that it has remained in use here to this day are proof positive of its great reliability in trachoma. Hippocrates (535), Galen (536), Celsus (537), Avicenna (538), and Prospero Alpini (539) regarded phlebotomy as the best means of eradicating severe trachoma. Their views are shared by Vetch (540), Ware (541), Reid (542), Edmonstone (543), Penada and Lanzoni (544), Assalini (545), Scarpa

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(532) See Article 75.
(533) See Articles 74-75.
(534) See Article 75.
(535) See Hippocrates, "Opera omnia", l. c., Sect. V, page 689.
(536) See Galen, l. c., volume 7, Lib. IV, page 183.
(537) See Celsus, l. c., pages 288 and 301.
(538) See Avicenna, l. c., Lib. III, Fen. III, Tractat. I, Cap. 9, pages 222-223.
(539) See Alpini, l. c., pages 58-62.
(540) See the German translation of the English text of Vetch, l. c., pages 61, 64, 71, and 74.
(541) See Ware, l. c., page 24 of Appendix.
(542) See Reid, quoted by Omodei, l. c., page 125.
(543) See Edmonston,e quoted by Omodei, l. c., page 133.
(544) See Penada and Lanzoni, quoted by Omodei, l. c., pages 122 and 129.
(545) See Assalini, l. c., page 117.

(546), Vasani (547), Farrel (548), and Kluyskens (549). Several of our contemporaries are so convinced of the advantages of venesection that they advise its use in every case until the patient actually faints, even if the patient loses thirty, forty, or sixty ounces of blood thereby. The latter course must always be eschewed, because its real object can be attained just as well without recourse to such extreme measures, which are harmful to the whole body (550).

Opinions differ widely as to where venesection is to be performed. Prospero Alpini gives a detailed account of the Egyptian practices which govern the opening of the blood vessels of the forehead, of the temples, of the inner canthus, of the ears, of the nose, of the lips, of the tongue, of the occiput, and of the extremities. Farrel and Kluyskens feel obliged to regard incision of the temporal artery as the chief source of good effects in logado-blennorrhea. Farrel even recommends that both temporal arteries be opened simultaneously, and that patients remain standing during the flow of blood in order to hasten fainting, which he regards as particularly beneficial. -

I have let blood from different veins and arteries of trachoma patients, and my wide experience convinces me that the best venesections are always those which enable us to draw off the most blood in the shortest time with the least difficulty. Accordingly, where veins located at the surface of the arms are large enough, ordinary brachial venesection is selected because then any amount of blood desired can very easily be drawn off speedily and certainly through a large enough opening. In the cases where depth or minuteness of those veins contraindicates brachial venesection, the temporal artery is to be used if well ramified. There are two reasons why temporal arteriotomy may not be practised indiscriminately, as many physicians are inclined to. In spite of a rather complicated operation on the highly ramified temporal artery, arteriotomy often fails to draw off more blood than the abovementioned phlebotomy does. Furthermore, we can stop hemorrhages from the temporal artery only by strong pressure (which impedes circulation to a harmful degree), by ligatures which are hard to apply, or by apinful vascular acupressure. All other methods of incision (opening of the frontal arteries, of the lacrimal vessels, of the jugular veins, et cetera) are permissible only in very special circumstances, when neither the brachial veins nor the temporal arteries lend themselves to a speedy and copious evacuation of blood.

The next best thing to general bloodletting in the synochal form is recourse to several antiphlogistic salts, particularly saltpeter [potassium nitrate] and cream of tartar [potassium bitartrate]. Both act as specific depressants on the cardiovascular system, but, in comparison with the actions of venesection, they may be used only as adjuvants during pronounced synocha. We give approximately two drachms of saltpeter within twenty-four hours, and approximately two half ounces of cream of tartar within the same period.

Purgatives composed of tamarind, sodium sulphate, and magnesium sulphate are, in addition ot venesection, particularly beneficial in cases where it is desired to use refrigerants and at the same time derivatives via the intestinal canal.

(546). See the letter by Scarpa in Nuovi Commentari di medicina, Padua, volume 1, semestr. I, pages 204-211, number 5, March 1, 1818. (Especially 205).

(547) See Vasani, l. c., page 78.

(548) See Farrel, quoted by Omodei, l. c., page 129.

(549) See Kluyskens, l. c., pages 62-64 and 68-69.

(550) See Ware, l. c., page 24 of Appendix.
See Farrel, quoted by Omodei, l. c., page 129.

Article 218.

b) Topica.

Local bloodletting does the most good where it is employed after venesection. Here much depends on the method selected. Scarifications of the eyelids and of the conjunctiva (551) and also such bold excisions of the conjunctiva for the purpose of immediately evacuating the vessels of the diseased part proved to be injurious, on the whole, because the vascular vitality was increased more by the traumatic irritation than it was decreased by the bloodletting. Leeches are more beneficial, since, while causing relatively less trauma, they remove far more blood. Yet even their use is approved only when we apply them in large numbers around the orbital region in the usual way for mild palpebral swelling, and, on the contrary, directly to the eyelids for marked swelling. I had from ten to twelve leeches applied to each eyelid of patients who suffered in the latter way. In other diseases it would scarcely be possible to employ leeches properly, simply as a matter of space. But here, where ther is enormous swelling of the lids during severe attacks, it is easy to apply leeches (552). Several complications attending the application of leeches near lids, formerly condemned for the best of reasons, need not be feared in the present circumstances. As I became more and more convinced of the good effects of this procedure, it was repeated once and even twice a week in stubborn cases until the swelling had uniformly gone down and stayed down, making the abatement of the disease a foregone conclusion. Since leeches were more than anything else instrumental in opening the way for saving the eyes of many trachoma patients, I cannot recommend their correct application warmly enough to my colleagues.

We must not expect good results with the other topica ordinarily employed to counteract the synochal form except after local bloodletting. Many trachoma patients obtained relief by smearing their lids with cream; others preferred to place linen compresses that had been dipped in milk, marshmallow [Althaea] decoctions, mallow [Malva] decoctions, or elder-flower [Sambucus] decoctions upon their eyes. Human milk is likewise recommended for this purpose even by Galan (553) and Alexander of Tralles (554). The refrigerant action of cabbage leaves or alder [Alnus] leaves applied to the lids is soothing. Alexander of Tralles says that the leaves of the violet are particularly good for this purpose (555). Cold poultices of pure water applied by means of light-weight compresses almost always rendered valuable service when the lids became very hot, but we may by no means use them indiscriminately (556). All the conditions which generally determine the indications and contraindications of the latter practice must always be given the most careful consideration in these circumstances, too (557).

Now that I have listed the measures which do good, I must not neglect to list the remedies which, though recommended for trachoma in general, never do anything but harm in genuine synocha. Foremost among them are the widely praised warm poultices; they invariably aggravate synocha considerably through the supply of body fluids, and through the accumulation of body heat in the diseased tissue. Just

(551) See the article by Wardrop in the Bibliothek für Ophthalmologie, volume 1, page 231, 1819.
(552) See table two.
(553) See Galen, l. c., volume 6, de remed. parat. facit., chapter 28, page 429.
(554) See Alexander of Tralles, l. c., Lib. II, page 124.
(555) See Alexander of Tralles, l. c., Lib. II. page 124.
(556) See the German translation of the English text of Vetch, l. c., page 54.
(557) See Article 234.

as much harm must be expected also from the various astringents and stimulants ordinarily used to counteract trachoma; such remedies make the process gain ground internally (thanks to the fact that the discharge is held back by force), and the anomaly spreads its destruction to the depth of the eye with the greatest of ease (558). In the third place we must rule out all instillations, all painting with a brush, and all injections because here even the most indifferent medium (indeed, even tepid distilled water), when applied directly to the conjunctiva, produces harmful shock simply by contact (559). Lastly, as regards all widely recommended (560) skin diseases to be induced far from the eye, the inunction of various kinds of unguentum acre, and the application of vesicants to the nape of the neck, behind the ears, et cetera, they are always harmful in the synochal type of vegetation; this is because every intense irritation of the skin causes a corresponding irritation of the conjunctiva.

Article 219.

c) Diet and regimen.

Both diet and regimen must be carefully tempered to the debilitating drugs. Highly seasoned and very hearty dishes are harmful. Patients must avoid beer, brandy, and wine; they may eat semolina soup, water gruel, and stewed fruits; they may drink vinegar with water, lemonade, or decoctions of agriots sour cherries . If the trachoma patient fails to eat sparingly and to eat cooling food, if he eats heartily, if he consumes spirituous liquors, the trachoma makes a decided gain. Indeed, it may spread from the eye to the brain, and then by producing encephalitis cause death. Vasani (561) reports a fatality that occurred in this way, where after death the cerebral meninges presented an excess of blood, the ventricles were distended with blood, and the thalami optici were found hardened (562). Vetch (563), who saw the disease relapse to its former degree of violence in an English hospital, says: "this, however, was attributed, and with some degree of probability, to an increase in the diet, which was raised from low to half, and in some cases to full, a circumstance which always seemed to aggravate the disease".

As regards the temperature of the room, it must be noted that cool air is always better than warm air for the synochal form.

Lastly, since in this form excitement of any kind invariably exacerbates trachoma, all patients must in general preserve their peace of mind and avoid physical exertion as much as possible. As taught even by the oldest schools of medicine (564), patients must particularly avoid all forms of light altogether by remaining in totally dark rooms (565).

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(558) See Article 230.
See Marescotti, quoted by Omodei, l. c., pages 121-122.
See the letter by Scarpa in Nuovi Commentari di medicina, Padua, volume 1, semestr. I, pages 204-211, number 5, March 1, 1818. (Especially 205).
See the German translation of the English text of Vetch, l. c., page 54.
See Vasani, l. c., page 86.
See Bartolozzi, quoted by Vasani, l. c., page 87.

(559) See Article 204.

(560) See the German translation of the French text of Frank, l. c., page 77.
See Mongiardini, quoted by Omodei, l. c., page 151.
See Farrel, quoted by Omodei, l. c., page 133.

(561) See Vasani, l. c., pages 74-75.

(562) Compare these findings with the interesting autopsy report made by Professor Mayer of Bonn, quoted on page 100 of the article by P. F. von Walther in the Journal der Chirurgie und Augen-Heilkunde, volume 2, pages 36-165, number 1, 1821.

(563) See the English text of Vetch, l. c., page 89.

Chapter II. Treatment of the erethistic form of logado-blennorrhea.

Article 220.

Increased nervous activity appears as the predominating element in erethistic trachoma (566). Here internal and external sedatives which diminish the sensitiveness are generally indicated to restore things to normal. Their indiscriminate use is utterly out of the question, however, because there are so many types of erethism. It is much better to use sedatives in conjunction with debilitants when erethism tends toward synocha, sedatives alone when erethism continues to occupy a middle position, and sedatives plus tonics when erethism tends toward torpor (567).

Article 221.

a) Treatment of erethism tending toward synocha.

If the erethistic form closely resembles the synochal form (568), the mode of treatment to be applied hardly differs, on the whole, from the one used to counteract pure synocha (569). Bloodletting is always indispensable, at least in the beginning. Even Assalini (570), who is none too enthusiastic over phlebotomy, asserts that he was almost always obliged to resort to it in the treatment of trachoma. No matter how necessary bloodletting accordingly is in severe erethistic trachoma at the outset, on the other hand we may no longer prescribe it so boldly here as we do for genuine synochal trachoma. Ordinarily we accomplish our object simply by a single venesection and by a single application of leeches in the prescribed manner (571). If the venesection ceases to afford relief, if it increases the restlessness and twitching of patients, if it is followed by an immediate increase in the acute pain, further bloodletting is superfluous and even harmful.

Refrigerant salts which we prescribe for true synocha (572) are beneficial in this erethism when they are used in conjunction with some opium or henbane Hyoscyamus niger .

In every other respect, and particularly as regards treatment with both local remedies and diet proper, the treatment of advanced erethism is identical with the treatment of synocha (573).

Article 222.

b) Treatment of erethism midway between synocha and torpor.

Where we find erethism midway between synocha and torpor (574), narcotics do good when used alone or with mercurials as adjuvants.

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(564) See Celsus, l. c., page 488.
(565) See Article 197.
(566) See Article 77.
(567) See Article 77.
(568) See Article 77.
(569) See Articles 216-219.
(570) See Assalini, l. c., pages 114 and 118-119.
(571) See Articles 217-218.
(572) See Articles 217-218.
(573) See Articles 218-219.
(574) See Article 77.

I place opium first on the list of narcotics which proved especially reliable when taken internally. It was found best to administer it after proper bloodletting. In the cases where certain physicians saw that opium was productive of no benefit (575), the abovementioned directions were certainly not adequately followed. We usually find that the effects of one grain of opium last a whole day. I had to prescribe stronger doses only for those patients who had already become largely immune to narcotics; every overdose was followed by severe headache, vomiting, and distressing restlessness. When Frank states that, as a rule, one grain of opium must be given every hour (therefore twenty-four grains a day), the obvious difference between his dose and ours must be due to a difference in weights or preparations (576). Opiates usually afford the greatest relief when taken two hours before the onset of pain.

The action of other narcotics was less reliable, on an average. This applies particularly to the widely acclaimed Digitalis purpurea (577). In mild doses it seldom reduced the nervous activity enough, and in strong doses (a drachm a day) it was invariably followed by vomiting, which is very common in severe cases of trachoma without that (578). I was more apt to obtain good results with henbane [Hyoscyamus niger], cherry laurel water [aqua laurocerasi], and cherry laurel oil [oleum laurocerasi] (579). According to the experiments of von Walther and Riffart, when six to eight drops of Prussic acid prepared according to Vauquelin's method were given daily in refracta dosi, the effects were beneficial.

If pure narcotics do not soon bring relief in pure erethism, they must be combined with mild mercurous chloride. In an emergency we give, at hourly intervals, a powder composed of one sixth of a grain of opium, one grain of mild mercurous chloride, and some magnesia. If the attacks do not stop even after this, the dose of mercury is doubled. Many patients who took that mixture received thirty, forty, sixty, and eighty grains of calomel [mercurous chloride] within a few days without showing any effects save the abatement of attacks. I stopped trying to induce derivations (through actual salivation from mercury, or through diarrhea) as soon as their repetition showed that such actions of mercury were always a great disadvantage and were only exceptionally of some advantage.

The best topica to use, with the same precautions as in synocha (580), are purple foxglove [Digitalis purpurea], Prussic acid, belladonna, and several opium preparations. Vasani had infusions of Digitalis purpurea applied as poultices (581). Fomentations composed of ten to twenty drops of Prussic acid (prepared with the Vauquelin technique) dissolved in six ounces of distilled water are praised by von Walther and Riffart (582). My own experience was that, as a rule, the best results were obtained with aqueous infusions of belladonna where two drachms of the leaves had been used to yield a filtrate of eight ounces. Here I never saw the different harmful reactions on the nerves which certainly occur elsewhere whenever the use of

(575) See the English text of Vetch, l. c., page 88.
(576) See the German translation of the French text of Frank, l. c., page 82.
(577) See Vasani, l. c., pages 79-80.
(578) See Vasani, l. c., pages 79-80.
(579) See Articles 207, 286.
(580) See Article 218.
(581) See Vasani, l. c., pages 79-80.
(582) See Riffart, quoted on page 139 of the article by P. F. von Walther in the Journal der Chirurgie und Augen-Heilkunde, volume 2, pages 36-165, number 1, 1821.

belladonna is intensive and protracted for any length of time (583). When twenty to thirty drops of lukewarm alcoholic solutions of opium were rubbed in around the edge of the orbit in the evening, many patients found that the nocturnal attacks of pain were much less severe. Another remedy which proved helpful here was a powder composed of equal parts of opium and of dried belladonna extract; in order to rub it in, we placed a little powder upon the point of a knife and dissolved the powder in some sputum or water. Ointments composed of unguentum hydrargyri cinerum and opium powder were just as helpful occasionally. Poultices of the abovementioned kind are employed constantly at first; later they are employed every three hours or every six hours (584). The inunctions recommended may be carried out once or twice a day near the margin of the eye in the skin of the forehead and cheeks.

The regimen and diet to be prescribed here are exactly like the ones in synocha. When patients in the middle stage of erethism eat highly seasoned food, expose themselves to bright light, or become over-excited in general, their condition soon becomes critical (585).

Article 223.

c) Treatment of erethism tending toward torpor.

If erethism shows a distinct tendency toward torpor (586), if the trachoma is of fairly long standing, if patients complain merely of moderate discomfort, if both antiphlogistics and soporifics [sopientia] have already been administered, the latter must be combined with the right tonics to prevent actual torpor.

When there is practically no remission of the disease, aqueous decoctions of Peruvian bark [Cinchona] are prescribed internally in addition to the sedatives listed in the preceding article. Where pain appears at regular intervals, where it is purely intermittent, it is particularly helpful to give Peruvian bark [Cinchona] treated with alcohol, together with some opium, a few hours before the paroxysm.

Collyria composed of opium and a small amount of metallic salts may never be neglected. The principal mixture which proved efficacious was the one composed of opium and an aqueous solution of bichloride of mercury whose formula constitutes Article 291. We employ it simply for fomentations when erethism shows but slight tendency toward torpor. If the heat developing is slight, we employ that collyrium lukewarm. Moreover, while strictly observing the general regulations necessary in all moist poultices, it is to be applied constantly during the first few days alone, but later only every three or six hours (587). We employ it for instillation when a marked tendency toward torpor is already present. Sometimes it must be diluted with equal parts of rose water for this purpose. If there is excessive reaction even to weaker mixtures on the part of the conjunctiva, if the abnormal sensations increase progressively after every instillation, if the pain following marked euphoria is not merely of short duration, the time to apply drugs directly to the eye has not yet arrived.

Cutaneous irritants, particularly vesicants, used as derivatives and applied to the upper arm, to the nape of the neck, or between the shoulders, are highly beneficial in torpid trachoma as a rule (588). Vetch's experience and my own both show, however, that the first irritation induced by means of the above is more effective than that secretion produced by keeping wounds open for a rather long period. If vesicants decrease trachoma appreciably, their application must therefore be renewed frequently. Another noteworthy point is that vesicants aggravate every aspect of trachoma in many individuals, for some unknown reason; in such cases they will have untoward effects only if we persist in using them.

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(583) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformein", l. c., page 50.
(584) See Article 218.
(585) See Article 219.
(586) See Article 77.
(587) See Articles 204, 218, 234.

Although the diet and regimen here require no considerable change, they do differ from the ones prescribed earlier (589). The chief difference is that here patients need no longer be denied meat soup and boiled meat. A little porter and wine diluted with water must be recommended rather than forbidden. The good effects of even a moderate amount of light in erethism tending toward torpor are shown by the fact that all patients presenting this form of trachoma, when placed in fairly sunny rooms, got well faster than patients whose treatment was continued in completely darkened rooms.

Chapter III. Treatment of the torpid form of logado-blennorrhea.

Article 224.

Tonics, widely used since antiquity to counteract logado-blennorrhea (590), are indicated where torpor prevails. Since there are many degrees of torpor (591), we must use drugs of corresponding potency to counteract it. As a precaution here we begin this treatment with mild tonics, and we proceed to more intensive remedies only when it is clear from the use of the former that no harmful excitation can result from the latter.

In the torpid form, if we do not try to increase the patient's powers of resistance, if instead antiphlogistics are administered (perhaps even empirically), mild trachoma becomes long drawn out, and more advanced trachoma destroys the eye by colliquation (592).

Article 225.

a) Tonics for internal use.

Peruvian bark [Cinchona] ranks first among internal remedies used to counteract torpor. Without it radical cure of stubborn trachoma due to weakness is in many cases utterly out of the question. As the first step in the purely tonic treatment I prescribe mild decoctions of Peruvian bark [Cinchona], together with valerian infusions. Concentrated decoctions with senega, camphor, and naphtha as adjuvants were beneficial in the later stages. Where diarrhea developed, a suitable does of arnica was given in addition. If constipation appeared, I had bitter extract of calamus and wine added. When patients were slow to recover I found it best to use Peruvian bark [Cinchona] pulverized to the maximum of fineness and combined with cinnamon, mace, cardamom, or a little white pepper.

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(588) See Omodei, l. c., pages 121-151.
See the German translation of the French text of Frank, l. c., page 77.
See Assalini, l. c., page 117.
See Ware, l. c., page 30 of Appendix.

(589) See Articles 219, 221-222.

(590) See Hippocrates, "Opera omnia", l. c., Sect. II, page 154, and Sect. IV, page 407.
See Celsus, l. c., page 293.
See Galen, l. c., volume 2, Lib. II, de differentilis febrium, page 157, and volume 8, in aphorismos Hippocratis, page 183.
See Aetius of Amida, l. c., Lib. VII, Cap. 7 and 11.
See Paul of Aegina, l. c., Lib. III, Cap. 22.
See Brigges, Pugnet, and Bongiovanni, quoted by Omodei, l. c., pages 121 and 154-155.
See Omodei, l. c., page 140.
See the letter by Scarpa in Nuovi Commentari di medicina, Padua, volume 1, semestr. I, pages 204-211, number 5, March 1, 1818. (Especially 205).
See the German translation of the French text of Frank, l. c., pages 79 and 89.

(591) See Article 78.

(592) See Article 78.

Article 226.

b) Tonics for external use.

There are several alcoholic collyria and several metallic-salt collyria which are recommended for fomentations and instillations in torpid logado-blennorrhea.

Of those collyria we employ the following as poultices. Pure alcohol, when diluted with two to four parts of water, often has excellent effects. The negro folk remedy, whose chief component is arrack (593), is certainly valuable in torpid trachoma. Dilute spirit of camphor is particularly efficacious in certain cases. If the general condition indicates decreased irritability more than anything else, alcoholic collyria alone are seldom adequate; we must then use metallic salts as adjuvants. Mixtures found useful for this purpose are white vitriol [zinc sulphate], blue vitriol [copper sulphate], lapis divinus [aluminated copper], and lead acetate; their respective formulae appear near the end of book six (594). These fomentations, like all moist ones, may never be kept on all the time, either (595); they appear to do most good when applied every three or six hours, the eyes being covered with dry camphorated compresses during the intervals (596).

For purposes of instillation and painting with a brush we select either mild alcoholic preparations of opium, or those solutions of metallic salts which serve for poultices (597). Tincture of opium, diluted with from three to four parts of water, is applied to the conjunctiva at first. Only when this application is followed by a reaction that is merely slight and short-lived is it safe to instil metallic solutions. If the physician fails to observe that precaution in selecting the latter, they are sometimes followed by severe exacerbations or by spreading of the disease to the deeper parts of the eye. -

Up to the present I have found no drugs besides the ones mentioned which are truly beneficial in atonic trachoma. Although Vasani (598) states that he saw good results obtained with antimony tartrate, well founded objections have already been made to it (599). Vasani dissolves from ten to fifteen grains of tartar emetic in one quart of water and injects some of it under the lids ten times a day. I should never care to employ the antimony salt recommended for trachoma in general, at least not as often as prescribed by Vasani; I say this not only because of the pains which attend it, but also because its external application always increases the degree of secretion.

Lastly, we prescribe vesicants here entirely in accordance with the rules which

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(593) See Article 194.
(594) See Articles 289-290, 294-295.
(595) See Articles 218-222.
(596) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., page 30, Article 52.
(597) See-Articles 289-290, 294-295.
(598) See Vasani, l. c., pages 135-136.
(599) See Omodei, l. c., pages 135-136.

I listed for the treatment of erethistic trachoma manifestly tending toward torpor (600).

Article 227.

c) Diet and regimen.

Patients presenting torpor are first given small portions and later given larger portions of nourishing bouillon, roasted and boiled veal, mutton, or beef, bitter beer that has ceased fermenting, and some wine. Where the latter cannot be procured we give from two to four "half ounces" of brandy a day, at least to such patients as are especially accustomed to spirituous liquors. Even the oldest physicians - even Hippocrates, Galen, and Celsus - highly esteemed a roborant diet, and especially the giving of moderate amounts of good wine, as effective against logado-blennorrhea (601). Frank (602) had his eye patients drink eight "half ounces" of brandy a day, and states that this practice brought quicker relief to a great many of them. -

The admission of light may be no means be as restricted as in synocha or erethism; Omodei (603), on the contrary, reports that in torpor the sick room must not be any lighter than when there is merely a tendency of erethism toward torpor (604). When this form is clearly present, the statement applies even to those trachoma patients still perceptibly suffering from photophobia (605). -

In the presence of torpor a lower temperature of the rooms does more harm than good. Patients presenting torpid trachoma therefore always recover much faster in rooms that are warm enough than in chilly, unheated quarters. -

Patients presenting mild logado-blennorrhea accompanied by torpor must be allowed outdoor exercise; it must be actually required of such patients rather for the sake of toning up their general condition, in accordance with the rules listed earlier (606).

Section three. Treatment based on the degree of development of trachoma.

General aspects.

Article 228.

In this type of treatment we aim directly at the nature of trachoma. Since this disease consists in an idiopathic formation of cellular tissue, as I explained earlier (607), here everything depends on properly restricting that liberation of cellular tissue. Now, we generally attain this purpose by means of those measures which increase cohesion, and particularly by means of the right choice of drugs containing oxygen.

(600) See Article 223.

(601) See Hippocrates, "Opera omnia", l. c., Sect. II, page 154, and Sect. IV, page 407.
See Galen, l. c., volume 2, Lib. II, de differentilis febrium, page 157, and volume 8, in aphorismos Hippocratis, page 183.

(602) See the German translation of the French text of Frank, l. c., page 79.

(603) See Omodei, l. c., page 142.

(604) See Article 223.

(605) See Article 274.

(606) See Article 201.

(607) See Article 56.

Article 229.

The acid preparations used to counteract trachoma are derived in part from the vegetable kingdom, and in part from the mineral kingdom. The vegetable preparations which we use are certain complex acids and various astringents (whose chief components are tannin and gallic acid). The mineral preparations which we use are several monobasic acids, certain metallic salts, and various perfect and imperfect metallic oxides. Vegetable preparations are used more seldom, on the whole, because their unstable composition makes them act on the eye less uniformly than mineral preparations do (608).

The greater or lesser local influence of the above preparations depends mainly on the following circumstances. For one thing, those substances increase the cohesion of the cellular tissue in direct proportion to the higher oxidation that they possess; acids and metallic salts have the strongest action, even metallic oxides are less active, and protoxides are least active. For another thing, the more that these drugs are diluted, the more is their efficacy decreased; therefore, for example, simple metallic oxides when concentrated produce marked changes, whereas perfect but very dilute acids and metallic salts produce simply a slight change. Furthermore, the efficacy of acid substances varies likewise with the part of the organ with which they come in contact; when they are applied to the outer skin of the lid, they always check the proliferations of the cellular tissue much more slowly than when they are applied to the delicate, loose conjunctiva which is easy to penetrate. Lastly, the effect of vegetable and mineral oxides depends also on their combination with hydrocarbons; in other words, all compounds containing oxygen are always much less likely to further cohesion of the cellular tissue if they contain more belladonna, opium, or camphor.

Article 230.

Generally speaking, the principle that, when the anomalies of sensation and structure characteristic of logado-blennorrhea are more pronounced, finer distinctions must be made holds good for the use of all acid substances approved so far. -

When over-activity of the nerves and active proliferation of the cellular tissue are present [discharge of pus] , trachomatous secretions always reach the danger point. When the nervous activity is considerably diminished and there is absolutely no proliferation [watering] , trachomatous secretions always become definitely colliquative. When trachoma is midway between the two [discharge of mucus], the secretions are not entirely without danger on the one hand, but on the other hand they are very apt to be followed by destructive exhaustion if they last too long.

In the first case [discharge of pus] , therefore, all strong preparations of oxygen which suppress the secretions by force, when prescribed in violation of the principle just listed, produce either a notable exacerbation of the anomaly, or permanent degeneration of the proliferated cellular tissue. In the second case [watering], therefore, if we select mild remedies which do not promote cohesion sufficiently, incipient logado-blennorrhea is not checked, and advanced logado-blennorrhea is not prevented from causing more or less degeneration of the affected part (609). In the third case (wherever the disease lies midway between the two extremes mentioned [discharge of mucus]), therefore, both the strongest and much less potent preparations are harmful, since here the function of secretion is restricted too rapidly by the former and too slowly by the latter preparations. Let us now

(608) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., the preface and also pages 69 and 106.

(609) See Articles 160-175.

compare the account of the degree of action of acid drugs given in the foregoing lines with the degrees of trachoma just mentioned. We shall then understand why, on an average, we most often use the most highly oxidized preparations in watering, less highly oxidized preparations in the discharge of mucus, and the least oxidized preparations in the discharge of pus. In other words, we shall understand why the earliest stage of trachoma calls for acids and metallic salts, why the middle stage calls for oxides, why the fastigium calls for protoxides. We shall also understand why we must dilute acid medicinal substances with narcotics in marked sensitiveness of the eye, and on the contrary reduce the use of such corrigents in decreasing sensitiveness.

Article 231.

Since trachoma by its very nature responds only to treatment which increases the cohesion of the cellular tissue and restricts the power of secretion, all remedies which make the texture lose its cohesion or which promote the act of secretion are harmful when their action is direct. That is why we may never prescribe emollients, pure narcotics, cataplasms, aromatic fomentations, and warm fomentations where it is necessary to direct treatment solely against the nature of the disease.

Article 232.

We must be very careful about including direct treatment among the others indicated. We must rule it out when, prechance, it is in direct violation of those rules (610) which appear necessary to eradicate long-continued harmful influences, or to mitigate very advanced forms. In these circumstances, if the physician fails to abide by the latter therapeutic rules, a great deal of harm always comes from the continued presence of serious causes, as well as from the progressive advance of the type of vegetation in question (611).

On the contrary, the immediate application of direct treatment is indicated where it in no way violates those two rules, or where in general remote causes have long since ceased to exist and the form present is not particularly advanced (612). Here any delay is absolutely contrary to the specific measures which alone can check the disease immediately.

Since our discussion of this treatment has been general up to the present, it still remains to discuss its special application as determined by the three stages of development of trachoma. I shall accordingly give a detailed account of the direct treatment of watering first, of the discharge of mucus in the second place, and of the discharge of pus in the third place.

Chapter I. Direct treatment of watering.

Article 233.

Since watering which represents the beginning of trachoma does not differ in nature from watering which marks the end of trachoma, the direct treatment of watering in either stage is identical (613). In all stages of trachoma watering is very apt to disappear because it differs so little from normal conditions as far as anomalies of sensitiveness and structure are concerned, and because no considerable secretions of incremental fluids are required for it to disappear altogether. The more

(610) See Articles 194-227.
(611) See Articles 195, 215.
(612) See Article 215.
(613) See Articles 2-6, 21.

detailed account of the following remedies shows most convincingly in what way both (a) approved cold compresses (614) increasing the power of cohesion by drawing off the heat and (b) certain vegetable and mineral preparations of oxygen (615) are to be carefully adapted to every patient presenting watering.

Article 234.

a) Cold water.

Cold water from the sea, from rivers, and from springs is warmly recommended by Prospero Alpini, Cumming, Brigges, Vetch, and Kluyskens (616). For centuries Egyptians with sore eyes have made pilgrimages to the tomb of Abu-Mandur (revered as holy ground), in order to recover their health through repeated ablutions of their eyes with the clear, fresh water from a cistern situated there (617). On the other hand, we see the use of cold water condemned by several authors; it is reported particularly by Bongiovanni, Baltz, and Weinhold that in many cases it was not only without any good effects, but even had manifestly bad effects (618).

My own observations show that improper selection of cases is chiefly responsible for that contradiction. I always found that cold compresses were harmful (sometimes from increasing, sometimes from spreading the anomaly) in the following circumstances: when watering was associated with a marked degree of torpor; when watering had been brought on my raw weather; when watering was secondary to catarrh, arthritis, syphilis, psoriasis, or any other constitutional disease; and when watering had already become firmly established as the result of manifest structural anomalies (619). I always obtained good results with cold water, on the contrary, in two types of cases: where watering was attended with noticeable over-activity of vessels and nerves (620); and where absolutely no serious structural anomalies as yet appeared to accompany watering occasioned by dust, heat, glare, or spread of the contagion. In my opinion, the following mode of use is best: a deep dish filled with freshly drawn water is placed beside the patient; several fairly large compresses, stitched six times at the edges, are placed in the dish; as soon as one compress begins to lose its coolness, a fresh compress is taken from the dish and applied to the lids. After some instruction in the use of these compresses, the patients usually apply them better themselves than when helped by others. Moreover, as in the case of all other moist remedies for the eye, the constant application of these compresses is necessary only at first; later on they must not be applied oftener than every three or six hours (621). If cold water agrees with the patient, the symptoms of watering abate visibly, and often so rapidly that complete recovery takes place as early as inside of seven days.

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(614) See Article 228.
(615) See Article 230.
(616) See Alpini, l. c., page 24.
See Loeffler, l. c., pages 317-318.
See Cumming and Brigges, quoted by Omodei, l. c., pages 137-155.
See the English text of Vetch, l. c., page 85.
See Kluyskens, l. c., page 21.
(617) See Article 304.
See Denon, l. c.
(618) See Bongiovanni, quoted by Omodei, l. c., page 137.
See Weinhold, l. c., page 21.
See Baltz, l. c., page 64.
(619) See Article 230.
(620) See Articles 217-218.
(621) See Articles 180, 203, 220, 225.
See the book by C. F. Graefe, "Repertorium augenärztlisher Heilformeln", l. c., pages 199-202.

Article 235.

b) Vegetable preparations containing oxygen.

The vegetable medicinal substances used to counteract watering are vinegar, citric acid, gallnuts, curcuma, and cismatan [the seeds of Cassia absus Linn.] (622). The first two are prescribed for ablutions and fomentations, but the last two are used in powder form and applied to the conjunctiva. Several investigations made it clear that all vegetable drugs containing oxygen customarily used by us have too vague an action for us to rely on them (623).

That is why I call attention here solely to the seeds of Cassia absus Linn., which have not yet been tried out in Europe. In the land of the Nile the plant is called chichm, tschischm, and cismatan. It is brought by caravans from Darfur to Cairo for sale. When ground and covered with water, the result is a very viscous fluid giving off a pungent and somewhat aromatic odor at the same time. According to an analysis undertaken at my request by Professor John, the fine black pods of the seed in question contained not only an extractive substance but also an astringent substance and free acid. Owing to the small number of grains which I obtained at that time, quantitative analysis of the components could not furnish sufficiently reliable figures.

Some physicians make it a rule to have cismatan pulverized with an equal amount of sugar after the seeds have been cleansed, washed repeatedly, and then dried in the sun. Other physicians employ cismatan with such adjuvants as lemon juice, alum, gallnuts, or curcuma. Some of the powder prepared in either of the ways described, about as much as would equal a barleycorn, is shaken right upon the eyeball by means of small coins. This drug will prove useful only at the beginning and at the end of trachoma, only when the eyes are free from severe pains and hypersecretion. It must be absolutely forbidden during the fastigium of trachoma. Of the Europeans who visited Egypt, Frank is the one to give cismatan special praise (624).

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(622) See the German translation of the French text of Frank, l. c., pages 10-23 and 28.
See Omodei, l. c., page 153.
See Assalini, l. c., page 128.
See Farrel, quoted by Omodei, l. c., page 139.
See the book by C. F. Graefe, "Repertorium augenarztlicher Heilformeln", l. c., pages 40-82 and 106-119.

(623) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., classes seven and nine, those of astringents and of acids.

(624) While this book was being printed, I received so large a shipment of cismatan direct from Cairo that it is now possible to arrange for a thorough analysis. I plan to publish the results in the fourth volume of the magazine which von Walther and I edit. [Translators' note: See the article by C. F. Graefe in the Journal der Chirurgie und Augen-Heilkunde, volume 4, pages 164-183, number 1, 1822.]
See Assalini, l. c., pages 127-128.
See the German translation of the French text of Frank, l. c., pages 18, 23, and 28.
See the German translation of the French text of de Candolle, l. c., page 160.

Article 236.

c) The most acidulated mineral preparations.

We have such preparations (625) administered subsequent to cold water if the latter does not bring sufficient improvement (626). We start the course of treatment right with such preparations when there is any objection to the use of cold compresses (627). The inorganic acids which we select are primarily concentrated hydrochloric acid and dilute sulphuric acid; I had from two to four drops of the former and one or two drops of the latter shaken out into four drachms of distilled water. Metallic salts were generally more efficacious than acids; I found, as did other physicians (628), that the derivatives of iron, zinc, and mercury which gave the best results were lapis divinus [aluninated copper], zinc sulphate, and sublimate [mercuric chloride]. I had one or two grains of the first two products and and one sixth or one eight of a grain of the last product dissolved in four drachms of rose water. Lapis divinus [aluminated copper] agreed best with very delicate individuals; zinc solutions were preferable for the average case. When the eye had become so accustomed to these two drugs that their further use produced no abatement, sublimate [mercuric chloride] still proved helpful on many cccasions. All patients in the stage of watering who present over-activity of the nerves must be given metallic salts with narcotics as corrigents. For this purpose I mix from twenty to thirty drops of vinous or alcoholic tincture of opium with four drachms of the collyria just recommended. Vinous solutions of opium are preferable at the very beginning, whereas alcoholic solutions are preferable when watering is of long standing.

Directions for use of that collyrium include instillations once or twice a day, and compresses as prescribed (629). Fomentations alone are usually to be prescribed for sensitive patients. As a rule, only instillations were tolerated by individuals who had constantly been exposed to cold, storms, and dampness, who were suffering from catarrh, rheumatism, and gout (630). A combination of both forms is generally beneficial where scrofula prevails.

If we find genuine synocha or erethism present in watering, metallic salts exacerbate the disease; here the forms mentioned must always receive first consideration (631). In watering, too, all remote causes must be definitely eradicated: if even minor harmful influences continue present, direct treatment sometimes diminishes the ocular disorder for a short time, to be sure, but never for long (632).

When acidulated minerals are applied to the conjunctiva, they always result in burning, excessive lacrimation, and increased redness. However, if those drugs are

(625) See Article 229.
(626) See Article 234.
(627) See Article 234.
(628) See the book by Larrey, l. c., volume 1, page 212.
See Assalini, l. c., pages 116 and 128.
See the German translation of the English text of Vetch, l. c., page 56.
See Farrel, quoted by Omodei, l. c., page 145.
See Ware, l. c., page 121.
See Bongiovanni, quoted by Omodei, l. c., page 121.
See Marescotti, quoted by Omodei, l. c., pages 121-122.
(629) See Articles 218, 222.
(630) See Articles 212, 234.
(631) See Articles 216, 219.
(632) See Articles 195, 215.

used the right way, this reaction lasts but a short time and is then followed by marked relief, greater ease in moving the eyeball, and less epiphora. This treatment must not be stopped until watering has completely disappeared. Incipient watering of long standing is much slower to go away.

Men whose cure is so far advanced by one or the other treatment that no trace of watering remains are subjected to certain preventive measures, those prescribed for convalescents of this type in an earlier part of my book (633).

Chapter II. Treatment of the discharge of mucus.

Article 237.

The stage of discharge of mucus, whose causes and forms are to be treated entirely in accordance with general principles, does not always require special direct treatment. If it progresses or regresses *rapidly*, it appears only as a short stage of transition to the most severe or least severe form of trachoma (634). In these circumstances the treatment necessarily coincides with that of the first stage or with that of the last stage of trachoma, depending on whether the intermediate stage is regressing toward watering or progressing toward the discharge of pus (635). Only where the middle stage is long drawn out does it become an entity, and only there does it consequently require specific treatment (636).

As early as the stage of discharge of mucus structural anomalies can usually be perceived. Here, therefore, we can no longer recommend remedies which promote cohesion of the cellular tissue to the highest degree, cold compresses, acids, and potent metallic-salt solutions (637), as a rule. On the contrary, the proper drugs here are generally those which are somewhat less efficacious in reducing the secretion, particularly certain metallic oxides. Their use has two effects: either they steadily eradicate the condition until recovery is complete; or they reduce the condition, after it has alternated between the symptoms of discharge of mucus and the symptoms of watering, merely to the lowest stage of trachoma. In the first case we stop the above treatment without proceeding further; in the second case we conclude it with measures to counteract watering. Of all the approved metallic oxides, moreover, those so far found best for this purpose are *red mercuric oxide* and *white mercuric oxide*.

Article 238.

a) Red precipitate.

This oxide is a perfect mercurial oxide rich in oxygen. Many physicians never give it save with various adjuvants. Consequently the efficacy of the different compound ointments prepared in this way depends largely on mercury alone (638). Red precipitate is applied to the outside of the lid when patients are sensitive, and to

(633) See Article 192.
(634) See Article 12.
(635) See Article 12.
(636) See Article 12.
(637) See Article 229.
(638) See the book by C. F. Graefe, "Repertorium augenarztlicher Heilformeln", l. c., pages 155-160.
See the book by Larrey, l. c., volume 1, page 213.
See the German translation of the French text of Frank, l. c., pages 78, 85, and 87.

the inside of the lid when patients are not very sensitive. Ten grains of red precipitate are combined with two drachms of fresh cerate of almond oil for external use at first (639). The former, the stronger mixture, is to be applied to the outer skin of the lid only once or twice a day; the coating must be so thin that not the least bit of it can reach the conjunctiva. We put a dab of the weaker mixture, the size of a lentil, upon the tip of a miniature brush; we apply it near the inner canthus, not only under the lower lid (which is to be pulled down), but also under the upper lid (which has been drawn upward sufficiently). To ensure proper distribution of the weaker mixture, as soon as the brush has been removed the patient is told to bend his head backward far enough, and his closed eyelids are massaged gently with the fingers. Since this treatment causes sharp reactions on the part of the eyeball which last several minutes and readily become excessive when incitant influences are present, I have the lids painted only at bedtime, and I have the diseased part covered for the night with linen compresses as prescribed (640).

When red precipitate takes effect, it does so inside of just a few days, as evidenced by a decrease in the blennorrheal secretion, by a gradual regression of the structural anomalies, and by the simultaneous disappearance of the anomalies of sensation. If the abovementioned signs of improvement continue unabated, this treatment is kept up until recovery is complete; where red precipitate helps only to the extent that the symptoms of discharge of mucus alternate with the symptoms of watering, we must resort to mercury ointment every evening, and to metallic-salf solutions every morning (641). If the discharge of mucus decreases (whether as the result of the oxide alone or as the result of the abovementioned combination) to watering without regressing further at the time, the mercurial ointment must be abandoned altogether. Treatment is to be completed solely with metallic-salt collyria, in accordance with the therapeutic rules listed previously.

In addition, I must recall certain important precautions to be observed in the use of red precipitate. -

Since red precipitate prepared in the ordinary way contains sometimes more and sometimes less nitric acid, it is edulcorated for a long enough period by means of hot water in order to obtain a drug having a uniform action. -

The physician must also make sure that the oxide is powered as fine as possible. If the salve feels at all gritty on being rubbed between the fingers, it cannot help being harmful, because all particles that can be felt (no matter how fine) set up inflammation of the eyeball mechanically (642).

In the third place, strictly fresh fat is positively the only kind to be chosen; ointments prepared from old fat increase the discharge of mucus immediately. -

Neither must it be forgotten that negligence in cleansing the eyes often has untoward effects (643). All particles of salve left upon the tarsus for any length of time (which have a marked affinity for oxygen, owing to the heat generated by the skin) soon turn rancid, and then reproduce to perfection that injury which otherwise follows the preparation only when originally bad.

Lastly, just as much consideration is due idiosyncrasy, which causes itching, burning, and erysipelatous or herpetic conditions immediately after the external application of any fat. Such a peculiarity of the skin compels us to relinquish red-precipitate altogether, and in its stead to prescribe very dilute solutions of metallic salts (644).

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(639) See the mixture called "Ceratum ophthalmicum", Article 297.

(640) See Article 193.

(641) See Article 236.

(642) See the method of preparation of "Hydrargyrum oxydatum rubrum venale" in the 1813 edition of the Pharmacopea borussica.

(643) See Article 204.

Article 239.

b) White precipitate.

White precipitate [ammoniated mercury] is composed of mercurial oxide, some ammonium, and just a little hydrochloric acid (645). Its renown in the field of trachoma was gained primarily through Janin's ointment (646), which received high praise from Schmidt (647) and from Scarpa (648). It is prepared from white precipitate, zinc oxide, Armenian bole, and lard; its formula constitutes Article 298. Owing to the addition of bole containing iron, this remedy (which because of its hydrochloric acid content is moreover at once more like metallic salts) ranks even somewhat above the red mercuric oxide recommended previously (649). But in the same proportion that it is thus more conducive to cohesion of the cellular tissue, it is, on an average, indicated for all types of logado-blennorrhea against which milder oxides are to be prescribed much less than for those types which require more acidulated drugs (650). I found white precipitate most effective where red precipitate had long been prescribed with meager results, particularly where, although red precipitate had greatly diminished the structural anomalies, the secretion remained in large measure unaltered. In the use of Janin's ointment, much depends on applying it right after sensitiveness has developed in every case. In order to satisfy this requirement, that ointment is combined at first with two parts of lard and later with one part of lard; it is not given undiluted until patients tolerate the latter combination.

In every other respect we are careful to use white precipitate (if, in accordance with the principles listed, it deserves to be preferred to red) with the same precautions which must be observed in using red precipitate (651). Lastly, let me note in addition ~~that~~ recently Staff Surgeon General Büttner obtained many cures simply by using white precipitate; he mixed one drachm of it with one ounce of lard, and had one to two grains of it applied to the eye daily (652).

Chapter III. Treatment of the discharge of pus.

Article 240.

Those oxygen preparations which act least intensively to reduce the loss of cohesion of the cellular tissue serve to check the discharge of pus (653). Now some of these are protoxides which by nature have little influence on cohesion, owing to

(644) See Articles 228-229.

(645) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformein", l. c., pages 155-160.

(646) See Janin de Combe Blanche, l. c., page 456.

(647) See pages 62-64 of the article by Schmidt in the Ophthalmologische Bibliothek, volume 3, pages 1-74, number 1, 1805-1807.

(648) See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 1, page 15.

(649) See Article 238.

(650) See Articles 228-229.

(651) See Article 238.

(652) See Buttner, quoted in the article by C. F. Graefe in the Journal der Chirurgie und Augen-Heilkunde, volume 3, pages 105-109, number 1, 1822.

(653) See Article 230.

their low acidification; others are certain approved metallic salts diluted with enough camphor to impede their power of promoting cohesion (654). -

Protoxides are preferable in the discharge of pus accompanied by increased sensation (655). Where the over-activity of nerves is excessive, hydrocarbons in addition must be used as corrigents of these drugs. Only when severe nervous reactions begin to subside a little are the abovementioned corrigents superfluous and even harmful (656).

Camphorated solutions of metallic salts are most useful in discharges of pus where nervous activity is below normal rather than above normal. More concentrated mixtures are indicated if the discharge continues over a long period. Here, if they are diluted with much water, they are practically without effect when they reach the diseased suface, because they are largely decomposed by the flood of albuminous secretions. Dilutions of these mixtures are used where the flow is slight, because in these circumstances collyria with a high metallic-salt content (which suffer hardly any decomposition from the small amount of the secretion) necessarily cause greater changes (657).

As long as the use of protoxides or camphorated metallic salts abates the discharge of pus, we continue it. Usually the discharge of pus is reduced merely to the discharge of mucus by means of these oxygen preparations. In this case the physician selects measures approved for counteracting the intermediate stage of trachoma (658). If this method (the use of perfect metallic oxides) reduces trachoma to its lowest stage, we stop the use of these drugs likewise and proceed to employ primarily means of counteracting watering. Where the discharge of pus is rapidly reduced to watering, almost without going through the stage of discharge of mucus, we are justified in having treatment of the discharge of pus followed immediately by treatment of watering as prescribed (659).

Before I point out how protoxides and camphorated metallic·salts are adapted to each individual case for the purpose of stopping the discharge of pus, I have still to call attention to one fact. These remedies suffice only when the discharge of pus affects a small area; but, when the discharge covers a greater area (where the flow appears not as blepharo-pyorrhea but as ophthalmo-pyorrhea), they must positively be combined with measures which, within the shortest time possible, prevent the anomaly from penetrating to the deeper parts. In discussing these two types of extent, I shall give a detailed account of remedies efficacious in blepharo-pyorrhea first, and then of the adjuvants necessary in ophthalmo-pyorrhea.

A. Treatment of blepharo-pyorrhea.

Article 241.

a) Lotio nigra.

Black mercurous oxide has been found to be the most beneficial of all imperfect metallic oxides. It is obtained from the decomposition of one scruple of calomel [mild mercurous chloride] by six to eight ounces of lime water (660). This precipitates the mercury, together with a little calcium and a very small amount of hydrochloric acid, in the form of a black powder that does not dissolve in water.

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(654) See Articles 229-230.
(655) See Articles 229-230.
(656) See Articles 229-230.
(657) See Article 230.
(658) See Articles 237-239.
(659) See Articles 233-236.
(660) See Article 292.

By no means do I regard the metallic component as solely responsible for the splendid healing virtues of that collyrium, whcih were repeatedly evidenced in several hundred patients whom I treated personally (661). Part of the benefit results because this combination contains an alkaline earth (calcium), which in certain circumstances cannot be declared inferior to the other fixed alkalis in sedative powers, anti-spasmodic powers, the power to reduce proliferation, and the power to increase resorption (662).

Depending on the different degree of sensitiveness present, we use black wash pure or with narcotics. If the presence of a high degree of nervousness necessitates narcotics (663), the right ones are those which have the most specific action on the eye yet contain the least sharp and resinous ingredients, chiefly Hyoscyamus and belladonna (664). The amount of henbane [Hyocsyamus niger] which we use for milder cases is half a drachm of extract to seven ounces of black wash. We use belladonna where reduction of the nervous activity is of the utmost urgency; its formula constitutes Article 293. Such corrigents are continued only until the sensitiveness begins to abate and the palpebral swelling begins to lose its high tension. As soon as this purpose has been achieved we prescribe lotio nigra unadulterated (665). The indiscriminate addition of narcotics is apt to be followed by exceedingly harmful atony.

Let us stress the following points regarding its mode of use. As a rule, black wash is used only for fomentations. I never gave it as instillations because it is beneficial only where ther is increased sensitiveness, during which applications directly to the conjunctiva are forbidden (666). Lukewarm compresses with black wash are usually best. It is self-evident that the medicine bottle must be shaken well every time before compresses are dipped in it, owing to the poor solution of the protoxide. We have those compresses applied constantly for some time, two to three days, but after that only every three or six hours (667).

If synocha and erthism increase from time to time during this treatment, we must always give it up altogether (668).

Where causes of disease continue present, blepharo-pyorrhea is never permanently reduced by compresses of black mercurous oxide. Here, too, therefore, careful consideration must always be given the etiologic factors, as explained before (669).

Black mercurous oxide is often applied just for a few days, only four to seven, in general. Sometimes its use must be continued for two weeks. Not until pain has disappeared almost completely and the doughy relaxation of the palpebral swelling has lasted for three or four days, in blepharo-pyorrhea, can we replace black wash

(661) See Article 229.
(662) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., page 96.
(663) See Article 240.
(664) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., page 45.
(665) See Article 292.
(666) See Articles 230, 237.
(667) See Articles 218, 222, 234.
See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., pages 199-202.
(668) See Articles 216-223.
(669) See Articles 194-214.

by stronger astringents. If the use of black wash is stopped too soon and if black wash is replaced earlier by camphorated metallic salts, exacerbation of the disease is certain (670).

Article 242.

b) Camphorated metallic-salt collyria.

Such mixtures were used long ago by Ware and by Schmidt to counteract ophthalmia neonatorum (671). -

Ware calls Bates's aqua camphorata (which is composed of blue vitriol [copper sulphate], Armenian bole, camphor, and water) "pre-eminently useful" (672). The filtrate of that mixture does not contain a trace of the bole; it contains not only some dissolved camphor but also all the vitriol originally added (673). Schmidt prefers his own collyrium, which is prepared from zinc sulphate, vinegar of lead [solution of basic lead acetate], spirit of camphor, and water (674). Repeated tests with the latter preparation showed that in it the zinc remaining dissolved is no longer combined with sulphuric acid but with acetic acid, while the precipitated lead is no longer combined with acetic acid but with sulphuric acid.

Both drugs, heretofore used chiefly to counteract ophthalmia neonatorum, have recently been prescribed with success for the Egyptian ophthalmia as well (675). My own experience shows that they are indicated in the discharge of pus particularly when the nervous activity is diminished and the palpebral swelling is subsiding. If the nervous activity is not much below normal, Bates's aqua camphorata is excellent; where, on the contrary, we find the nervous activity greatly diminished and colliquation imminent, Schmidt's prescription is more suitable. As long as the conjunctiva does not tolerate direct contact (676), camphorated metallic-salt solutions may be used only on compresses (677). When the reverse is true, we apply them not only to the outside of the lid but also to the inside of the lid. The method used for fomentations with black wash (678) is repeated for fomentations with these collyria. Instillations are to be given following the method described earlier in connection with cleansing of the eye. In no circumstances is that fluid to be applied to the conjunctiva oftener than two or three times a day. In all cases only harm results, owing to mechanical irritation, from more frequent instillation and above all from "injecting this lotion once at least in every hour", as advised by Ware (679).

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(670) See Articles 229-230.

(671) See Article 105.

(672) See Article 294.
See Ware, l. c., page 35 of Appendix.
See page 130 of the article by Schmidt in the Ophthalmologische Bibliothek, volume 3, pages 107-152, number 2, 1805-1807.

(673) See Article 294.

(674) See Article 295.
See page 141 of the article by Schmidt in the Ophthalmologische Bibliothek, volume 3, pages 107-152, number 2, 1805-1807.

(675) See Macgregor, quoted by Omodei, l. c., pages 152-155.
See the letter by Scarpa in Nuovi Commentari di medicina, Padua, volume 1, semest. I, pages 204-211, number 5, March 1, 1818. (Especially 206).
See the English text of Vetch, l. c., page 112.
See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 1, page 210.
See Ware, l. c., pages 19 and 35-36 of Appendix.

(676) See Articles 230, 240.

(677) See Articles 217, 222, 225, 230, 232.

(678) See Article 240.

Fungous ectropion dependent on the stage of the disease very usually develops during the period when these aqueous collyria are employed to counteract blepharo-pyorrhea (680). This is accodingly the place to discuss the treatment of this accident. -

If the eversion is purely fungous and not excessively large, there must be no delay in its reposition. The best way to perform this is as follows: the eyeball must be turned in the proper direction (681); the outside of the lid (drawn toward the edge of the orbit) must be pulled down toward the cornea with the fingers; an attempt must be made to push the inside of the lid (which is exposed) inward gently. In most cases the eyelid continues to remain in normal position when mild ectropion has been reduced as described. If, as an exception, this is not the case, if the granulating surface protrudes again, sooner or later (682), we repeat reposition at once; if the patient can tolerate light pressure, we now prevent recurrence of eversion by means of compresses fastened fairly tight. -

All attempts to restore the normal position of the lids directly are harmful in two conditions: Where the palpebral conjunctiva is already so swollen that there is no space left between the eyeball and the eyelids; where ectropion regresses only momentarily, or sarcomatous degeneration is beginning. In these circumstances even the slightest pressure (consequently, any bandage confining the swollen lids) is painful, thereby steadily increasing the pathologic process. We cannot cure these eversions (which are to be treated merely with compresses of camphorated metallic-salt collyria during the discharge of pus) until we have combated the primary disease by means of the preventive measures which eradicate true secondary ectropion (683). Consequently a purely fungous primary eversion requires, apart from its possible reposition as described, no further special treatment not already included in the rules for treatment of simple blepharo-pyorrhea.

As the loss of cohesion on the part of the conjunctiva is markedly reduced, the discharge of pus (whether or not it is now complicated by fungous ectropion) is reduced to lower stages of development within two to four weeks (684), thanks to the mode of treatment described so far. When the milder stages are reached, we stop the use of camphorated mixtures of metallic salts in accordance with the principles described earlier (685), and we conclude the treatment by employing drugs approved for combating the lower stages as prescribed.

B. Treatment of ophthalmo-pyorrhea.

Article 243.

Ophthalmo-pyorrhea is generally to be eradicated by the same method which we employ for blepharo-pyorrhea (686). The treatment of ophthalmo-pyorrhea differs from that of blepharo-pyorrhea in but one respect: here the remedies required by blepharo-pyorrhea are supplemented by remedies which give more assurance of preventing any further spreading of the disease. Two courses are now open to us to meet this requirement. In other words, if the discharge has spread to the inside of the eye (687), accompanied by increased anomalies of sensation but not yet by the anomalies of secretion and of structure peculiar to it, the pathologic irritation is to be treated with intensive escharotics applied far from the eye. If the discharge, accompanied by the characteristic anomalies of secretion and of structure, has already seriously involved the ocular chambers, we prescribe not only the abovementioned cauteries but also corneal puncture, in order to obviate the reflex action of the discharges (688).

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(679) See Article 204.
See Ware, l. c., pages 19 and 36 of Appendix.
(680) See page 132 of the article by Schmidt in the Ophthalmologische Bibliothek, volume 3, pages 107-152, number 2, 1805-1807.
(681) See the explanation of figure three of table five, given in Article 309.
(682) See Article 19.
(683) See Articles 248-253.
(684) See Article 19-21.
(685) See Article 240.

Article 244.

a) Escharotics producing revulsion.

Before employing escharotics to produce internal revulsion of severe anomalies of sensation (689), we must first obey all the instructions regarding bloodletting (690) and laxatives (691), if such be in order. The only good cauterizing agents are those whose effect is strong and at the same time lasting. Any other types not only fail to arrest the discharge but often do harm by causing a general increase in the irritability. My own experience would indicate that even the burning strongly recommended by our predecessors (692), whether effected with the cautery iron or the moxa, is for the most part inadequate. The pain resulting stops almost entirely when the fire is taken away, and consequently is much too temporary to check the advances of the disease.

We most often produce sufficient derivation by means of the following method. We have a round patch (whose circumference measures about nine to ten inches) shaven clean upon the crown of the head. Some adhesive plaster is then heated and formed into a cylinder between one and a half and two lines in thickness, and from it is prepared a circular piece between ten and twelve lines in diameter. This piece is made to adhere very firmly right to the depilated skin; around the piece is placed a strong ring of German tinder [amadou], which fits snugly. The next step is to fill the space delimited, for one line in height, with powdered lapis infernalis [silver nitrate], and then to seal it hermetically with a round plate prepared from plaster substance. Even if the latter is achieved, a piece of ordinary adhesive plaster is applied to the entire area of depilation, which is next covered with light compresses, and the whole dressing is kept in place by a four-tailed head bandage or a light-weight hair net [fillet]. Special pains must be taken to secure good adhesion of the ring of plaster; it must always lie flat against the scalp at all points. [Translators' note: A line is equivalent to 1/12 of an inch.]

The purpose of the ring of German tinder [amadou] is the immediate absorption of bits of the escharotic, which even despite all precautions sometimes escape from

(686) See Articles 240-242.
(687) See Articles 16-20.
(688) See Articles 17-20, 47.
(689) See Article 240.
(690) See Articles 207, 217.
(691) See Articles 207-208.
(692) See Hippocrates, "opera omnia", l. c., page 688.
See Alpini, l. c., Lib. II, page 98.

the plaster capsule; thus they cannot escape any farther away. Not many hours after the escharotic has been poured in (that is, when the lapis infernalis [silver nitrate] melts, owing to the evaporation from the skin), there begins right upon the cranium a sensation of burning which soon turns into the most acute pain. From the beginning of this action (which continues for twelve to twenty hours) on, the frightful lancinating and boring pain in the depth of the eye goes away almost altogether. The severity of the resultant pains is easy to guage when it is considered that lapis infernalis [silver nitrate] usually eats clear through the skin inside the capsule, that it sometimes destroys the galea aponeurotica at the same time, and that in rare cases (particularly where the scalp is very thin) it even penetrates into the bone tissue. When the caustic has remained on for the full twenty-four hours we remove the plaster capsule, scrape away all particles of lapis infernalis [silver nitrate] not decomposed, and then cover the eschar with rose salve [unguentum rosatum]. This bandage is renewed daily until the eschar separates. If the silver nitrate has been applied right, and if the plaster covering has hermetically sealed the dressing, the eschar is always at least a line in extent. After the shedding of the scab, which is sometimes slow to occur, the ulcer (which closes with unusual rapidity even where the bone was exposed) is bandaged with suppurative salves and kept open as long as genuine ophthalmo-pyorrhea continues (693).

Article 245.

b) Puncture of the cornea.

As a rule, this operation is indispensable in logado-blennorrhea which, partly through its anomalies of secretion and partly through its structural anomalies, penetrates to the deeper parts of the eye (694). Although puncture (because of the irritation resulting from the incision) must always be avoided if other means are at all adequate, it is always only in exceptional cases that further penetration of the disease can be stopped by copious venesection, drastic laxatives, and powerful caustics applied to the crown of the head (695). This is true even if the ravages inside the eye are mild, if the corneal stroma still appears clear and not much elevated, if the pain can be borne, and if the collection appears purely serous. The advantages of this operation are explained by the fact that it enables us directly to obviate the harmful reflex action which every discharge inside the eye causes, and thus to gain time for the use of collyria designed to arrest the discharge of pus (696). The outcome, sometimes more favorable and sometimes less so, depends partly on the stage of development of the disease present, and partly on the efficacy of the abovementioned treatment by counter-irritants. -

(693) I have already made mention of the use of these caustics for chorioiditis arthritica, in an earlier publication.
See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., page 138.

(694) See Articles 17, 47, 243.

(695) See Article 244.

(696) See Articles 17, 47, 240, 243.
See the article by Wardrop in the Edinburgh Medical Journal, volume 3, pages 56-62, number 9, January 1, 1807.
See the article by Wardrop in the Medico-chirurgical Transactions, volume 4, pages 142-187, 1813.
See Adams, quoted by Günther, l. c., page 57.
See Farrel, quoted by Omodei, l. c., pages 138-140.

Where the cornea is still clear or merely cloudy, where it is not very conspicuously elevated, where the serum discharged is pure or contains only slight traces of purulent fluid, puncture of the cornea permits restitutio ad integrum of the eye if the counter-irritation has been adequate. If the counter-irritation has not been adequate here, corneal puncture still has the advantage of diminishing the pain caused by the unavoidable destruction which accompanies the loss of sight. We are certain of recovery if the pains abate considerably right after paracentesis, if all cloudiness disappears rapidly, and if a marked tendency toward organic union is evident in the corneal incision. The sight is lost if the feeling of pain after the operation does not disappear soon, if the lips of the wound steadily become more everted while turning yellowish gray and while the edematous loss of cohesion increases. -

Corneal puncture can never save the sight when the discharge of pus is wide in extent, where trachoma produces serious anomalies of secretion and of structure in the eyeball, where the corneal lamellae are well elevated and dirty gray in color, and where the chambers are entirely filled with purulent secretion. Here the only thing that puncture can ever do is to shorten the frightful pain, and to preserve the ocular stump appreciably better than when rhegma has taken place.

I have but few remarks to make regarding the technique of this operation. If the eyelids are held fast as for a cataract operation, the surgeon makes the same incision that he would for extraction, cutting the cornea for the length of two Paris lines at its lower segment. It makes no difference here whether we open the chamber more toward the middle part, the outer part, or the inner part of the lower semicircle of the cornea. We select whichever of these sites is most accessible in the particular position of the eyeball. Many physicians make use of an ordinary cataract knife or a double-edged knife for corneal puncture. It is, however, easier to perform with a short blade somewhat curved toward the surface at the pointed end. Figure one of table five gives the natural size of such an instrument. Its broadest part, a. b., amounting to two Paris lines, is situated four and a half Paris lines away from the tip c., and from b. on proceeds by means of a shaft eleven lines long to d., where it fits into the handle. [Translators' note: The Paris or French line is equivalent to 0.088814 inch.]

Apart from this arrangement, the instrument in question is identical with the cataract knife recommended by me. Now, since an accurate description of the latter will be given later on, I refer readers to that description (697) for all points concerning the curvature of the tip for the right eye and left eye, the nature of the dorsum of the blade, and the length and form of the handle. An instrument of the construction specified gives us three advantages: there is little difficulty about introducing it between swollen eyelids; secondly, the puncture - when we keep the concave surface (698) turned away from the iris during it - may be undertaken with more confidence (699); lastly, the incision (not only because of the pressure on the cutting edge but - owing to the easier entry of the curved tip - also because of the further penetration of the blade) can be performed more safely (700).

(697) See Article 269.
See figures seven, eight, and nine of table five.

(698) See Article 269.
See figures seven, eight, and nine of table five.

(699) See Article 269.
See figures seven, eight, and nine of table five.

(700) See Article 269.
See figures seven, eight, and nine of table five.

After we have punctured the cornea we never give instillations of any kind as long as the traumatic excitation lasts. In all other respects, however, we continue to treat the eye purely with the means which are to be used against the discharge of pus. When the discharge has been reduced to lower stages, we employ means appropriate to them (701).

Section four. Treatment of the sequelae.

Article 246.

Several widely known prescriptions recommended for the treatment of the sequelae of logado-blennorrhea proved to be perfectly reliable; other, on the contrary, appeared inadequate and even harmful. The use of the former instead of the latter was continued, but better prescriptions were sought. In the ensuing chapters my aim will be to give only a short account of the former measures, and to enter into details only for the recent measures employed with success.

Chapter I. Treatment of palpebral sequelae.

a) Treatment of secondary loss of cohesion of the conjunctiva.

Article 247.

Although we never find this condition (702) accompanied by symptoms which are serious in themselves, restitutio ad integrum is urgently necessary because if can do much harm both by recurring and by spreading contagion afresh (703). -

Treatment based on cause is carried out wholly in accordance with the same rules which govern the causal treatment of the condition when primary (704). -

Direct treatment is achieved in two ways: either by using drugs which promote cohesion, in order to restore the normal condition of the palpebral conjunctiva; or by destroying the surface of the palpebral conjunctiva to the proper degree. Which of these two ways is to be chosen is determined by the stage of development of the disease.

To counteract the very early stages I used cold compresses (kept on for several hours a day) of pure well water, or of water from the [German] springs of Pyrmont, Driburg, and Fachingen (705). During my stay in the Harz district [Germany] I found that the water of Alexisbad, rich in iron chloride, likewise rendered excellent services, particularly where secondary loss of cohesion appeared in the conjunctiva of scrofulous persons (706). If those compresses effect no improvement, we order compresses of aqua sappharina (707), or instillations of an aqueous solution of bichloride of mercury (708). We have the palpebral conjunctiva painted daily with unadulterated tincture of opium where the increased sensitiveness continues present. We have all the diseased tissue painted twice a week with vinegar of lead [solution of basic lead acetate] where atony prevails. If either of the measures mentioned

(701) See Article 240.
(702) See Article 26.
(703) See Articles 26, 168, 188, 191.
(704) See Articles 195-214.
(705) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., pages 108-115.
(706) See the book by C. F. Graefe, "Der salinsche Eisenquell", l. c., pages 59-60.
(707) See Article 296.
(708) See Article 291.

is effective, we continue to use it regardless of how slowly improvement ensues.

But if the loss of cohesion does not respond at all to the alterative treatment (even when the latter has been continued for several months), if it persists as a structural anomaly, we must by all means proceed to destroy the degenerated conjunctival surface. Blue vitriol (copper sulphate) is recommended for this purpose when the loss of cohesion is fairly mild, and silver nitrate when the loss is greater. In order to achieve our purpose by means of these caustics, we must obey the following rules.

When we have arranged the patient as for cataract extration, his head is bent far to the right or to the left, thus allowing the tears during cauterization to drain through the canthus. The physician next everts the eyelid as prescribed (709), dries its inner surface with a soft wad of lint, and runs a smoothly rounded bit of vitriol or silver nitrate over the entire surface. After this the painted lid is left everted for some time. Reposition of the lids before stray particles of vitriol or silver nitrate, merely adhering to the cauterized wall, have completely decomposed causes severe pains in the eyeball, sometimes even actual inflammation of the entire bulbar conjunctiva. Depending on whether the loss of cohesion affects the lower lid alone or both lids, we apply this treatment solely to the lower lid or simultaneously to the upper lid as well. Such cauterizations are never repeated until the resultant inflammatory irritation has disappeared altogether. We must continue them until at least the greatest part of the velvet-like structure has been destroyed (710). The few remaining portions then yield to the abovementioned alternative treatment, even if they have previously resisted it for a long time.

Intercurrent blennorrheal or inflammatory processes receive treatment suited to their type, and here all means which are particularly helpful in counteracting secondary loss of cohesion but which happen to increase the concomitant condition are stopped at once.

Let me note further that we may be no means leave such individuals to their fate as soon as the loss of cohesion on the part of the conjunctiva has been arrested. It is much more prudent to make use of metallic-salt collyria for some weeks longer after recovery has taken place. In this way the conjunctival tissue steadily gains strength, and the tendency of the eye to suffer recurrences is steadily diminished in the same proportion.

b) Treatment of sarcomatous ectropion.

Article 248.

We never direct treatment against this sequela without first subjecting the eyeball to the most careful examination (711). Trachoma followed by ectropion commonly gives rise likewise to amblyopia, amaurosis, structural anomalies of the cornea, of the iris, of the lens, et cetera (712). If the physician overlooks such complications, and if the patient is not promptly informed of their inevitable consequences, both expect the cure of eversion to do more than it can do. Direct treatment of this condition is based on the degree of ectropion present. Mild remedies suffice for the cure of the early stages, whereas the advanced stages of sarcomatous ectropion yield only to drastic measures. I shall discuss the less in-

(709) See Article 309 for a description of and directions for using the hook designed to evert the eyelids. An illustration of this instrument will be cound in figure three of table five.

(710) See Article 26.

(711) See Article 27.

(712) See Articles 17, 19, 27.

tensive methods of treatment first, and then the more intensive ones.

Article 249.

Red mercuric oxide is preferred by A. Schmidt for the treatment of sarcomatous ectropion (713). I have often employed ointments containing this drug with success in counteracting mild ectropion. Where the conjunctiva is sensitive we use eight grains of the finely powdered oxide to two drachms of cerate of almond oil; where torpor is present the metallic oxide may be increased up to twice that amount (714). It is best to apply such ointments as follows.

The sarcomatous tissue is cleansed of mucus and any dried crusts. A brush dipped in those mixtures is then passed over all parts. A plumasseau [pad of charpie] completely covering the granulating surface is now applied, and is kept in place by two or three narrow strips of plaster. The dressing is changed once or twice a day, in proportion to the secretion increased by the [red] precipitate. In cases where even the weaker form of this drug causes severe reaction, we stop the use of mercury altogether for some time, and instead apply merely charpie dipped in lukewarm water. If the increased secretion checks the luxuriation so much that reposition of the diseased part to its normal position is easy (715), we must brush the ointment on exactly as we do in the discharge of mucus (716). In the latter case we continue its use until the palpebral conjunctiva is left merely like velvet at all points. At this time I abandon red precipitate and prescribe instead the course of treatment described in Article 247, which is particularly effective against secondary loss of cohesion on the part of the conjunctiva.

Article 250.

Silver nitrate is indicated in mild sarcomatous ectropion principally when red precipitate [red mercuric oxide] increases not only the secretion but also the eversion. Some physicians employ an aqueous solution of silver nitrate. My own experience shows that the crystals give better results in these circumstances. The technique of applying the dry form is almost identical with the technique employed in mere loss of cohesion on the part of the palpebral conjunctiva (717). In ectropion, however, the caustic point must remain in contact with the diseased surface much longer, and afterwards the latter must be properly covered with a plumasseau [pad of charpie] coated with fresh oil of almonds (718). Moreover, such cauterizations may never be repeated until the eschar has fallen off, and until the reaction set up has totally disappeared. When the condition improves steadily I continue this process until the lids, reduced in thickness and freed from exuberant granulations (719), resume their position with ease. Here, too, the treatment is then concluded with appropriate measures effective against secondary loss of cohesion on the part of the conjunctiva (720).

Article 251.

Mechanical extirpation is required where luxuriations are not lastingly diminished after mercury ointment or after the use of lapis infernalis [silver nitrate]. -

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(713) See page 150 of the article by Schmidt in the Ophthalmologische Bibliothek, volume 3, pages 107-152, number 2, 1805-1807.

(714) See Articles 237-238.

(715) See Article 242.

(716) See Article 238.

(717) See Article 247.

(718) See Article 249.

(719) See Articles 242, 249.

(720) See Articles 247, 249.

I can say nothing in favor of the mode of extirpation by ligature praised by the English (721). Its longer irritation always creates dangerous sympathetic reaction on the part of the eyeball; and, since the ligature fastened around the wide base of the sarcoma is very insecure, one is never sure whether it is too tight or too loose. -

Beyond peradventure, the more suitable extirpation with cutting instruments, which was the practice even in remotest times and which has been continued by several physicians up to the present, deserves preference (722). Here a knife is less reliable than scissors; when a knife is used, the result of excision is often far different from what it was intended to be, since the everted lid (even when held taut by a small hook) remains slippery. We operate with a small pair of scissors having rounded ends, firm, and curved toward the surface, because we are perfectly sure that these scissors will effect fixation and excision at the same time (723). For this operation I first have the everted lid held firmly by an assistant (724); the convex side of the opened scissors is pressed hard against the granulation; by bringing the blades together the granulation lying between them is excised. When all the sarcomatous material has been removed, the hemorrhage is stopped by repeated applications of a soft sponge dipped in cold water. The lid is put back in place and covered with compresses bandaged on loosely. -

There are two rules for post-operative treatment. We must combat the traumatic irritation, and we must eliminate the residual tendency of the sarcoma to recur. We combat the former with cold compresses (725). We counteract the latter, as soon as all inflammation has ceased, with the same mode of treatment which proves helpful in secondary loss of cohesion on the part of the conjunctiva (726).

Article 252.

Burning of the inside of the lid is an extreme measure, in my opinion. -

History teaches us that even in early times, to counteract trichiasis and distichiasis, a small cautery iron like a needle was introduced into the holes left after cilia had been removed (727). The literature contains no satisfactory reports on ustion of the inside of the lid. Although Hippocrates (728) and Celsus (729) speak of burning the eyelids, they do not specify what conditions are to be thus combated, and neither do they tell what place is to be cauterized. Percy (730) and Demours (731) make general mention of this means; however, neither of them bases his statement on any personal experience but solely on the exceedingly vague conceptions of the oldest school which I just mentioned. Moreover, neither do the better words on ophthalmology hint at burning the lids in general, and at burning the inside of the lids in particular. I shall mention only the writings of Janin (732), Lefébure (733), Richter (734), Arneman (735), Schmidt (736), Beer (737), Scarpa (738), Cooper (739), and Jourdan (740). Now, since there is no trustworthy evidence that the actual cautery has ever before been deliberately applied to the palpebral conjunctiva, I feel justified in regarding this method of ustion which I practise as a therapeutic procedure put on a sound basis now for the first time.

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(721) See the German translation of the English text of Vetch, l. c., page 71.

(722) See Aetius of Amida, l. c., Lib. VII, Cap. 70-71.
See Adams, quoted by Günther, l. c., pages 46-47.
See the German translation of the English text of Vetch, l. c., page 71.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, page 137.

(723) An illustration of these scissors will be found in figure ten of table five. See Article 309 for an explanation of the copper-plate engraving.

(724) See Article 309 for an explanation of figure three of table five.

(725) See Article 234.

(726) See Article 247.

(727) See Celsus, Paul of Aegina, Guy de Chauliac, and Paré, quoted by Percy, l. c., page 209.

(728) See Hippocrates, "Opera omnia", l. c., Liber de videndi acie, Sect. V, page 688.

(729) See Celsus, l. c., book 7, chapter 7, page 363.

(730) See Percy, l. c., page 205.

The good results obtained over many years by applying the cautery iron to oozing red spots of the eyelids (741), at my instance, led me to try it out in sarcomatous ectropion as well. I did so particularly during the campaign as well as later on, in cases (742) where eversion resumed its original degree within a very short time (sometimes before many days had passed), even after oft repeated and carefully performed excisions.

Before I describe the manoeuvre, I must specify what apparatus is required for it. Apart from the apparatus generally required to make the cautery iron white hot, it is composed of: several stout pieces of cardboard; two or three pea-shaped irons; a small glass full of oil of almonds; several plumasseaux [pads of charpie] coated with rose salve [unguentum rosatum]; and some small strips of plaster. We give that piece of cardboard the shape shown in figure sixteen of table five, and shortly before the operation we moisten its convex edge a. with water so that the sharp edge will be softened a little and will not injure the eye. The instruments for performing cauterization which I use are illustrated in figures eighteen and twenty of table five; there the engraving of the iron proper (figure twenty) is separated from the engraving of the handle (figure eighteen) merely to save space.

If all proper arrangements have been made, the operation is performed in the following way. An assistant, who takes his place at the side of the seated patient, stretches the retracted eyelid with the retractor applied under the sarcoma along the orbital edge from the outside in such a way that the maximum retraction is at-

(731) See Demours, l. c., volume 1, chapter 3, page 99.
(732) See Janin de Combe Blanche, l. c., page 375.
(733) See Lefébure de Saint-Ildefont, l. c., page 168.
(734) See A. G. Richter, l. c., third edition, volume 2, page 473.
(735) See Arneman, l. c., page 78.
(736) See page 150 of the article by Schmidt in the Ophthalmologische Bibliothek, volume 3, pages 107-152, number 2, 1805-1807.
(737) See J. G. Beer, l. c., 1792 edition, volume 1, page 35.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, pages 136-140.
(738) See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 1, page 148.
(739) See the German translation of the English text of Cooper, l. c., volume 1, pages 570-576.
(740) See Jourdan, l. c., volume 11, page 203.
(741) See Jung, l. c.
See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., page 211.
(742) See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut", l. c., page 16 (1816), page 4 (1817-1818), and page 4 (1819).
See Luce, l. c., pages 8-9 and 17-18.

tained (743). A second assistant, stationed behind the chair, holds the patient's head well to one side, so that the tears will drain solely through the inner canthus. If the copious flow of tears occasioned during the burning passes over the ectropion because of a different position [of the head], it has the disadvantage of cooling the iron at the moistened surface too soon, and of allowing some of the boiling fluid to penetrate back through the palpebral aperture to the eyeball. As soon as the fixation has been properly managed, the surface to be cauterized is carefully dried with a wad of lint. The surgion now slides the convex edge of the protective cardboard (figure sixteen of table five) between the everted lid and the eyeball, right up to the place where the palpebral conjunctiva turns into the sclera. He applies the pea-shaped tip of the cautery iron right to the sarcoma and, while pressing gently all the time, moves it slowly from one canthus to the other, to produce a somewhat hard, dark brown eschar upon the entire surface everted. If the iron loses its heat too early in the operation, it must quickly be exchanged for a second iron, and if necessary even for a third iron in very pronounced ectropion.

At the termination of the cauterization, pure oil of almonds is poured over the eschar, and the pasteboard inserted is not removed for a few moments, until the heat in the sarcoma has died away. Only then do we remove the protective cardboard and cover the diseased surface with a plumasseau [pad of charpie], which is to be fastened on with strips of plaster. I have never seen any serious sympathetic reaction on the part of the eyeball when the ustion was performed correctly. Moreover, almost all patients reported that the pain was severe but quite tolerable, and ceased almost wholly as soon as the cautery iron was removed.

As regards the immediate after-treatment, care must be taken at first to have an antiphlogistic regimen observed, to have the cauterized eye cleansed from mucus often enough (744), and to have the prescribed bandage renewed morning and evening. If the eschar separates, I have the plumasseaux [pads of charpie] necessary for the dressing moistened merely with lukewarm water. Fatty substances, if their use is continued over a long period, readily give rise to fresh eversions. Moreover, the period at which the eschar falls off varies greatly: where the sarcoma is rather loose it occurs earlier, and where the sarcoma is firmer it occurs later. As a rule, the eschar separates between the second day and the seventh day. While it is being shed the sarcoma steadily diminishes a great deal. In direct proportion as this decrease is greater, and as the individual granulations simultaneously become less elevated and less clearly circumscribed, the everted lid is quicker to resume its natural position. If the pathologic condition diminishes from day to day after the first cauterization, we have merely the abovementioned simple bandage applied. Where the sarcoma stops decreasing before it has diminished enough, cauterization must be repeated every ten or twelve days if the sensitiveness of the eye permits. We must not employ ustion until recovery is complete; where the lids are puffed up, cauterization is apt to have so marked an effect that the inside of the lid contracts too much during cicatrization and thus creates partial or total entropion. If the swelling has gone down, if the eyelid has resumed its normal position and its inner surface still has merely the appearance of velvet, the actual cautery is discarded; the remaining pathologic condition is combated with milder measures, those already listed in Article 247.

Let me add one remark in conclusion. I have made no special mention of restoring everted sarcomatous lids to their normal position because, even without fur-

(743) See the description of the palpebral retractor in Article 309, and figure three of table five.

(744) See Article 204.

ther surgical aid, reposition is almost always spontaneous, owing to the eradication of the granulations. Out of a great many cases, only two still presented ectropion after destruction of the sarcoma; here satisfactory results were obtained by cutting a triangular piece, including the tarsus, out of the mass of the eyelid and by uniting the divided surfaces with surgical sutures (745).

c) Treatment of entropion.

Article 253.

On the whole, I have but two remarks to make regarding this well known treatment (746). I found that a pair of forceps with ends curved like a sickle rendered excellent service in excising skin, where excision was indicated because of the presence of entropion. The excision of the palpebral margin is usually much too complicated (747).

Here I shall make no further mention of the palpebral pincette represented in figure fourteen of table five, since its superiority is sufficiently explained in the detailed description given in Article 309. Excision of the palpebral margin is indicated if sufficient eversion of the cilia cannot be secured in any way, of if genuine distichiasis necessitates this operation; we undertake it in the simplest and best way by means of the following technique.

First of all, in the zone to be extirpated, I grasp the palpebral margin firmly with tweezers similar to Bloemer's pincette (748) and differing from his only by the larger size of the body (749). Next, I draw the eyelid far enough away from the eyeball, thus stretching the tarsus to the degree necessary. Then by means of a small pair of scissors (firm, moderately curved at the surface, and having rounded ends), with one blade applied to the inside of the palpebral margin and the other blade applied to the outside, I cut away the requisite portion containing the hair roots; I made it a rule to cut from the outer canthus toward the inner canthus (750). If it were attempted to begin the incision at the inner canthus and continue it toward the outer canthus, the bridge of the nose would make this very difficult. Moreover, it is self-evident that in order to operate on a patient from in front, we must hold the scissors in the right hand for the left eye, and in the

(745) See the book by Adams, "Practical observations on ectropium", l. c., page 5.

(746) See A. G. Richter, l. c., third edition, volume 2, page 481.
See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 1, page 148.
See B. N. G. Schreger, l. c., page 136.
See Demours, l. c., volume 1, page 105.
See the German translation of the English text of Cooper, l. c., Lieferung 5, page 289.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, page 109.

(747) See B. N. G. Schreger, l. c., pages 139 et seq.
See Weller, l. c., page 66.
See the German translation of the English text of Cooper, l. c., Lieferung 5, page 304.
See Jager, quoted on page 523 of the article by Jüngken in the Journal der Chirurgie und Augen-Heilkunde, volume 1, pages 513-536, number 3, 1820.

(748) See Bloemer, l. c., page 730.

(749) See figures thirteen and twenty-one of table five, and the description of the copper-plate engravings in Article 309.

(750) See figures ten and nineteen of table five, and the description of the copper-plate engravings in Article 309.

left hand for the right eye. Any surgeon who finds it awkward to use the left hand for the right eye can always use the right hand for performing excision on the right eyelid as well, on two conditions: the patient's head must be bent far back; and the surgeon must be stationed in back of the patient instead of in front. All purposes which can possibly be achieved with exceedingly complicated, laborious, and painful operations are achieved by me just as fully with the abovementioned simple technique, and achieved in a much shorter time and with less pain to the patient (751).

d) Treatment of secondary ptosis.

Article 254.

Palpebral ptosis is sometimes a sequela, owing to secondary loss of cohesion on the part of the palpebral conjunctiva (752). In this event, it can be counteracted only by means of the measures which destroy the velvet-like texture of the palpebral conjunctiva (753). In those cases where ptosis is not accompanied by such loss of cohesion but results merely from pure paralysis which is more or less complete, its treatment requires measures of a different order which are a matter of common knowledge (754). I must not omit to state that several factors play a very important part in checking this sequela at an earlier date: time; being outdoors where the air is fresh and dry; and, in general, cheerful living conditions.

Chapter II. Treatment of sequelae affecting the ocular conjunctiva.

a) Treatment of ocular membranes.

Article 255.

Regarding the treatment of vascular and cellular membranes over the eye (755), I have but little to add to what is already acknowledged to be beneficial (756).

aa) Vascular anomalies were treated with both hydrochloric acid and phosphoric acid (757). Pannus often yielded to these drugs, even when it was of long standing. In order to be sure of success we must always apply both preparations in such a way that, although alterative, they by no means destroy the diseased clear cornea. The best way to achieve the purpose mentioned is to dip a miniature brush in either of these acids, to wipe it off carefully upon the rim of the bottle until it is simply wet, and then to pass it over the entire pannus (758). The time at which we repeat the painting is determined by the sensitiveness of the part affected. It was never permitted to apply acids oftener than once a day. Where conditions were otherwise good, complete cure was effected by either of these acids inside of three to six weeks.

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(751) See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut", l. c., sixth series, pages 3 and 18 (1821).

(752) See Article 29.

(753) See Article 247.

(754) See Janin de Combe Blanche, l. c., page 367.
See A. G. Richter, l. c., third edition, volume 2, page 489.
See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 1, chapter 5, page 138.
See J. G. Beer, l. c., 1792 edition, volume 1, page 21.
See Demours, l. c., volume 1, page 477.

(755) See Article 31.

(756) See A. G. Richter, l. c., third edition, volume 3, pages 139-150.
See Lefébure de Saint-Ildefont, l. c., pages 229-239.
See G. J. Beer, l. c., 1813-1817 edition, volume 1, pages 618-626; and volume 2, pages 630-648.
See Demours, l. c., volume 1, page 342; and volume 2, pages 444-447.
See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 1, chapter 11, page 299.

(757) See the 1813 edition of the Pharmacopoea borussica.

As it turned out, the classic excision of vascular fragments in pannus could neither be given unqualified approval nor be rejected altogether. All blood vessels present in the structure affected are products of the specific pathologic process: the more delicate and finer ones react entirely in proportion to the anomaly of vegetation present, therefore increasing and decreasing with it; the larger ones, which protrude conspicuously, become independent in the course of time and then make the ocular membrane continue stubbornly, owing to reflex action. No matter how carefully the former are excised, excision is never any guarantee of improvement, since small vessels of this kind always recur as the result of the anomalous condition. Excision of the latter, on the other hand, is of advantage in that it paves the way for the free action of drugs. Excision is greatly facilitated if, in detaching individual vascular bundles, we make use of Bloemer's pincette (759) to elevate and stretch the diseased part.

In cases where there is intercurrent ophthalmia of the synochal or erethistic type, it must always be combated first by means of treatment designed to counteract synocha or erethism (760) before proceeding to the use of acids. -

When definite dyscrasias accompany the ocular membrane, we suit the treatment to the respective dyscrasias (761); direct treatment never has lasting effects unless the dyscrasias have been eradicated. -

If pannus was of very long standing, after it had been cured we found it absolutely necessary to continue mildly astringent collyria for three or four weeks more to restore the strength of the conjunctiva (762).

bb) The treatment of cellular membranes always requires surgery. Here chemicals do good only because the degenerated part has been extirpated. Detachment with the aid of Bloemer's pincette is best secured by a small convex knife, the kind that I use for shaping in rhinoplasty (763). If occasional small impurities develop at the site of the previous pterygium after extirpation, they must be painted daily with simple tincture of opium; if the latter does not bring relief soon, they must be painted daily with the solution of silver nitrate whose formula constitutes Article 301.

My remarks on the treatment of concomitant dyscrasias and of intercurrent taraxis, and on the continued use of astringent collyria in the treatment of vascular anomalies, apply just as much to the treatment of pterygium.

(758) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., pages 209-212.

(759) See Bloemer, l. c., page 730.
See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut", l. c., pages 4 and 6 (1820).

(760) See Articles 215-223.

(761) See Article 214.

(762) See Articles 289-291.

(763) See the book by C. F. Graefe, "Rhinoplastik", l. c., figure three of table five, and pages 124 and 169.

b) Treatment of ulcers of the bulbar conjunctiva.

Article 256.

Ulcerations which take place in the bulbar conjunctiva as a sequela of severe trachoma (764) usually respond quickly to painting with Sydenham's laudanum [wine of opium], in most cases inside of a week. If they resist opium, as is particularly the case if they are very lardaceous in appearance toward their center, hydrochloric acid is applied to the ulcer just as it is in pannus. Favorable signs are subsidence of the lardaceous base and diminution of the special corona vascularis, which latter is never absent from these ulcers (765). If these changes are sufficiently pronounced, treatment with opium may be resumed. -

Where conjunctival ulcers are accompanied by intercurrent synochal or erethistic conjunctivitis, the latter must always be checked before starting direct treatment of the ulceration (766). -

Moreover, here we must attend to concomitant dyscrasias just as carefully as in the case of ocular membranes (767).

Chapter III. Treatment of corneal sequelae.

a) Treatment of corneal opacifications.

Article 257.

The integrity of the eye is far more often endangered than promoted by empirically prescribing just any of the numerous drugs recommended for corneal opacifications (768). If we are to obtain good results, in selecting drugs we must perforce give serious condiseration to the etiologic factor and to the nature of the anomaly (769).

The etiologic factor is of greater importance than is usually believed. Corneal opacities are never cured unless their cause has been cured. On the other hand, small dynamic specks often disappear altogether simply as the result of causal treatment. There are various methods which enable us to fulfill this requirement. Certain approved topica suffice to eliminate purely local causes, cilia turning inward, secondary loss of cohesion on the part of the palpebral conjunctiva, partial granulation of the bulbar conjunctiva, individual bundles of very extensive small vessels, idiopathic corneal ulcers, et cetera. The general treatment already described in Article 214 and also suitable resulsives must be used to counteract more widespread pathologic tendencies - that is, systemic conditions -, such dyscrasias as impetigo, arthritis, and syphilis. If corneal opacities continue present as the result of ill health, after a severe sickness, we give Peruvian bark, gentian, calamus, wine, nourishing food, and in addition we recommend that patients go outdoors where the air is dry.

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(764) See Article 32.
(765) See Article 32.
(766) See Articles 215-223.
(767) See Article 255.
(768) See G. J. Beer, l. c., 1813-1817 edition, volume 1, page 358; and volume 2, page 89.
See Lefébure de Saint-Ildefont, l. c., page 250.
See A. G. Richter, l. c., third edition, volume 3, page 122.
See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 1, chapters 8-9, pages 237-272.
See Demours, l. c., volume 1, section 5, chapter 1, pages 265-281.
See many passages in the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c.
(769) See Articles 34-37.

Where the nature of the anomaly is concerned, we must remember that direct treatment is indicated only where there is hope of improvement. It therefore appears to be contraindicated where the specks are completely adynamic, completely saturated, and chalky white. Such opacities never undergo resolution; on the contrary, they are apt to undergo malignant degeneration as the result of constant irritation; we must therefore let much anomalies alone in every case. Furthermore, small adynamic leucomas situated far from the pupil do not impair vision seriously. In the opposite case, where the spots are small but badly situated, or where they are very extensive, we can attempt to restore vision without a special operation on the cornea only by creating an artificial pupil (770). Direct treatment is indicated in all mild adynamic opacities and in all dynamic opacities. It cures the former. Depending on the stage of development reached, it either cures the latter completely, or at least reduces them so much that they lose their tendency to become still more exacerbated (771). In the following articles I shall explain how direct treatment is to be specially adapted to the three different kinds of opacities (772), those blennorrheal in nature, those inflammatory in nature, and those adynamic in nature.

Article 258.

aa) Treatment of blennorrheal corneal opacities.

Loss of cohesion on the part of the corneal tissue is responsible for these anomalies (773). Hence their direct treatment can be achieved only by means of oxygen compounds which increase cohesion, just as in the case of any true blennorrheal disease (774). In my opinion, the most efficacious oxygen compounds are zinc sulphate, mercuric chloride, and cadmium sulphate. They belong to the group of oxygen compounds hitherto employed without distinction to counteract opacities. Prominent in this group are cream of tartar, ferrous sulphate, copper sulphate, zinc sulphate, cadmium sulphate, sodium sulphate, verdigris [subacetate of copper], several oxides and salts of mercury, some vegetable acids, and gallnut powder (775). Aqueous solutions of those metallic salts are to be brushed on or instilled daily (776). At first, their application stops only the symptoms indicative of the blennorrheal nature of the opacity (777); later on, the opaque quality also diminishes. Where the disease is still in the early stages, the cornea completely regains its pellucid quality when the dynamic condition has come to an end. If the disease is already advanced, it is always followed by adynamic specks which are sometimes small and sometimes large, even if the process [of secretion] and the opacity have been decreased to some extent by means of metallic-salt collyria.

No matter how much good is in general accomplished by drugs containing oxygen in blennorrheal opacities, just as much harm is done there by using anything which promotes atony and the process of secretion. Fomentations, warm compresses, both fresh and rancid fat, acria, alkalis, and all mechanical measures make these specks become increasingly large and increasingly destructive (778).

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(770) See Article 265.
(771) See Articles 34-37.
(772) See Articles 34-37.
(773) See Article 35.
(774) See Articles 228-231.
(775) See the references quoted at the beginning of Article 257.
(776) See Articles 289-291.
See the article by C. F. Graefe in the Journal der Chirurgie und Augen-Heilkunde, volume 1, pages 554-555, number 3, 1820.
(777) See Article 35.

Article 259.

bb) Treatment of inflammatory corneal opacities.

When these opacities are present in the pure state, we are to treat them simply by means of local applications designed to stop inflammation. When they are accompanied by signs of definite change, we are to employ general treatment by means of those measures designed to stop imminent metaschematism [change in form] (779).

For the removal of the first variety of specks, which usually are superficial, the best services were rendered by decoction of mallow [Malva], out of all the drugs generally approved for destroying corneal opacities (780); next to it ranked tincture of opium, sometimes used pure and sometimes mixed with Hoffmann's anodyne [spirit of ether]. If marked sensitiveness accompanies the corneal disease, lightweight compresses of mallow [Malva] decoction are to be applied lukewarm to the eye for two to three hours morning, noon, and night. Where the anomaly develops without severe pain, we brush pure alcoholic tincture of opium over the diseased spot once a day. If very pronounced torpor accompanies the anomaly, the opium preparation just mentioned is particularly effective if we mix one drachm of it with twenty to thirty drops of spirit of ether. The treatment, to be applied in accordance with the rules prescribed, must be continued until the disappearance of all symptoms indicative of the inflammatory nature of the disease. Most of the time the cornea becomes perfectly clear again as soon as the symptoms just mentioned have disappeared. Only in exceptional cases are these milder stages of the disease followed by genuine adynamic specks.

In the second variety of inflammatory opacities (in those opacities which are deep and per se capable of causing secondary disturbances elsewhere), we must always note whether they are more inclined to degenerate into corneal abscesses or into vascular membranes. Where the pains grow much worse and the affected spot becomes elevated like a hill, the first consideration is to prevent the imminent suppuration. This is accomplished by applying leeches around the eye, by using compresses of mallow [Malva] decoction, by instilling vinous tincture of opium mixed with quince mucilage [mucilago cydoniorum], and by opening the head of the elevation as soon as it begins to show the slightest sign of pus. In this way we can control the suppurative degeneration (formerly unavoidable) at least to the extent of avoiding any large or destructive ulcer (781). If there is no tendency toward abscess formation on the part of inflammatory corneal opacities, if they are rather on the point of turning into anomalies resembling pannus (When the anomaly of sensation is decreasing and the vascular ramification has increased), the most urgent need is to prevent all further spreading of the vascular condition (782). These circumstances call for excision of all swollen small blood vessels as prescribed (783), followed immediately by painting with tincture of opium, and, if the latter does not bring improvement, touching up the diseased part of the cornea from time to time with concentrated hydrochloric acid (784).

(778) See Article 35.
(779) See Article 36.
(780) See the references on this subject quoted at the beginning of Article 257.
(781) See Article 36.
(782) See Article 31.
(783) See Article 255.
(784) See Article 255.

Wherever both simple and deep inflammatory opacities are present with intercurrent conjunctivitis or iritis, we prescribe all varieties of antiphlogistics (785).

In inflammatory opacities, all topica which are irritating and at the same time promote secretion are contraindicated. In such circumstances, harm is inevitably caused by gallnuts, pure alkalis, corrosive metallic oxides, vegetable acria, fatty ointments, cataplasms continued over a long period, et cetera. Those agents often cause the well circumscribed inflammatory process to involve the entire eye, and not seldom they alone are responsible for the fact that the opacity soon degenerates either into destructive telangiectasias of the cornea, or into highly dangerous abscesses (786).

Article 260.

cc) Treatment of adynamic corneal opacities.

Adynamic spots (787) can be eradicated only by stimulating the diseased tissue to efficient and more active metabolism.

We must without exception reject all mechanical forms of treatment known so far, multiple puncture of the opacities, scarification of the opacities, abrasion of the opaque lamellae, and dusting with crystal powder and glass powder (788). I never obtained the slightest benefit from these forms; on several occasions, on the contrary, they were followed by an obvious exacerbation of the condition, since the irritation caused by them gave rise to considerable exudations of plastic lymph.

What I just said of mechanical forms of treatment applies likewise, in every single respect, to artificial ulcers; it has been recommended that such ulcers be created right at the opaque spots by means of threads run through them at the surface, or of oft repeated cauterization (789).

Of the wide assortment of pharmaceutical preparations recommended for inveterate opacities, ammonium combined with walnut oil gave the most reliable benefit, in my experience. These preparations include different acria (790), some aromatics (791), certain fresh and rancid fats (792), several very corrosive metallic oxides (793), certain kinds of gallnuts (794), alkalis (795), and neutral salts (796). In

(785) See Articles 215-219.
(786) See Article 36.
(787) See Article 37.
(788) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., pages 187-190.
(789) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., page 143.
(790) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., pages 65 and 68-69.
(791) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., pages 29 and 33.
(792) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., pages 20-21.
(793) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., pages 142, 153, 156, 159, 161, 172-174, and 176.
(794) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., pages 71, 76, and 80.
(795) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., pages 98 and 101-105.
(796) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., pages 123-125.

order to test the degree of sensitiveness, the combination of ammonium and walnut oil is applied only weak at first, strictly in accordance with the formula which constitutes Article 300; it is brushed over the diseased portion of the cornea once or twice a day. If the conjunctiva does not respond to this mixture sufficiently, and if the speck shows no decrease, we add ammonium a drop at a time to make the mixture somewhat stronger. Sudden increase in concentration, which makes the eye remain reddened for days, is harmful. In certain individuals the procedure recommended cleared up the cornea completely even within seven to eight weeks; in others recovery was very slow. Nevertheless, the latter circumstance must never deter us from keeping up the good work. Where even any decrease in opacity can be detected, no matter how small, by persevering for long enough success will almost always be achieved. These healing virtues of ammonium are to be explained by the fact that it does good not only in a dynamic way by means of increased metabolism, but also in a chemical way as an alkali by means of deoxidation of the oxidized lymph perceptible in the opacities (797).

In the case of adynamic opacities, all drugs used to counteract both inflammatory and blennorrheal opacities are contraindicated. Narcotics (798) never effect improvement here, and for the most part collyria containing oxygen (799) cause aggravation.

b) Treatment of corneal staphylomata.

Article 261.

aa) Treatment of extension staphylomata.

If these staphylomata arise chiefly from blennorrhea of the cornea (800), the first step is to stop the anomalous process of secretion. All measures suitable for this purpose have already been discussed in detail in the article on treatment of blennorrheal opacities of the cornea; I therefore refer the reader to that article for all treatment directed against this cause (801).

If the corneal tissue appears free from concomitant blennorrhea, our sole concern is with the malformation:

Staphylomata which are inconspicuous, purely stationary, and pellucid are left to nature. They usually impair vision only to a slight degree, and for the most part the visual defect present (which results from excessive refraction of rays) can be overcome by a suitable concave lens (802).

Where corneal staphylomata are larger and at the same time elevated, the flow of lymph must be drawn away from the eye by means of laxatives or diuretics, cohesion of the colliquated tissue must be promoted by instillations of zinc collyria (803), and the aqueous humor must be evacuated from time to time by punctures in the

(797) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., page 98.
(798) See Article 259.
(799) See Article 258.
(800) See Article 39.
(801) See Article 258.
(802) See the article by C. F. Graefe in the Archiv für die Physiologie, volume 9, pages 225-236, number 1, 1809.
See the article by Dunglison in the Journal complémentaire du Dictionaire des sciences médicales, volume 6, pages 285-286, 1820.
(803) See Article 289.

manner prescribed (804). A single puncture is never of any help. Only oft repeated puncture during the administration of the internal and external remedies recommended produces, when conditions are otherwise favorable, gradual flattening. In several cases I found myself obliged to continue the abovementioned drugs for two and even three months and, during this period, to perform corneal puncture at intervals of eight or twelve to fourteen days before staphylomata of even moderate degrees were appreciably diminished or totally destroyed.

If the protrusion of the cornea is conspicuous from the start, if the entire treatment just described is of no avail, if the eye remains almost totally useless because of its excessive convexity, we proceed to lens extraction. We perform it here just as we do in cataract extraction (805). By removing the crystalline lens we not only promote sinking of the cornea but, in general, considerably diminish the excessive refraction of rays impairing vision (806).

Lastly, where extension staphylomata show very marked protrusion, where as complete blindness sets in they attain such proportions that the lids cannot close over the eye, the treatment indicated is identical with the treatment of total adhesion staphylomata (807).

Article 262.

bb) Treatment of adhesion staphylomata.

The treatment required by this anomaly depends on whether it is purely simple (sometimes partial, sometimes total), or has genuine complications (808).

α) Partial simple adhesion staphylomata do not always require treatment. If the condition remains stationary and gives no trouble, it is advisable to let it alone. In the opposite case, however, we must take steps to combat it. Excellent results are given here by butter of antimony; when painted over the diseased corneal tissue as prescribed (809), it produces characteristic irritations accompanied by the excretion of firm fibrin. When these irritations are repeated often enough, they endow the softened tissue with a degree of firmness which prevents any further extension. If the diseased spot is thus transformed into a purely adynamic, leucomatous swelling of moderate elevation, everything else depends mainly on the size and location of the opacity. Absolutely no treatment is required where such ves-

(804) See Article 245.

(805) See Article 269.
See the article by Adams in the Bibliothéque universelle des sciences, belles-lettres, et arts, volume 8 of the division entitled "Sciences et arts", pages 40-56, 1818.

(806) See the article by C. F. Fraefe in the Archiv für die Physiologie, volume 9, pages 225-236, number 1, 1809.
See the article by Dunglison in the Journal complémentaire du Dictionaire des sciences medicales, volume 6, pages 285-286, 1820.

(807) See paragraph beta of Article 262.

(808) See Article 40.
See Janin de Combe Blanche, l. c., page 343.
See Lefébure de Saint-Ildefont, l. c., page 271.
See A. G. Richter, l. c., third edition, volume 3, page 151.
See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 2, page 136.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, pages 72-210.
See Demours, l. c., volume 1, page 310.

(809) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., page 210.

tiges of a staphyloma are located at the scleral edge of the cornea (810). If they are close to the pupil and shut out light, we perform coremorphosis (811). Excisions of the diseased corneal portion, which seldom fail to destroy vision entirely, are in order only when partial staphylomata (after the application of butter of antimony and after the anomalous process has been eradicated), owing to their marked elevation, produce constant pains in the eye and frequent inflammations.

β) Adhesion staphylomata which are simple but total grow steadily and therefore may never go untreated. Sooner or later, malignant degenerations result from all merely alternative topica in this form of staphyloma. Nothing but complete destruction of the degenerated corneal tissue can prevent still more serious trouble here; we achieve this in various ways. -

I am opposed to removal of a staphyloma by ligature because the broad base of the excrescence affords little purchase, and because ocular pains over a long period are apt to cause marked sympathetic reaction in the parts of the brain so close to the eye.

Incisions of the cornea both lengthwise and across are to be censured almost as much; after them union of the lips of the wound often takes place within a short time, so that the staphyloma is as large as ever inside of but few weeks; and, if certain parts of the incision continue to gape, they are almost always transformed into cancerous hernias.

Total excision of the cornea is much more reliable. Scarpa, Beer, and Demours advise that this be performed in one of two ways: either by using a large cataract knife to detach the lower half of the staphyloma, just as in cataract extraction, and to sever the upper half by repeated sections (812); or in general by operating with Dumont's spring ophthalmotome, where no repeated application of the blade is necessary (813). The former method leaves a great deal to be desired; the latter is not very practicable because the spring lancet produces a wound surface which at all points continues obliquely into the ocular tunics and shows little inclination to heal, and thereby produces perfectly regular circular excisions which almost never correspond to the staphyloma.

My own technique has now been in use for many years at the Berlin clinic and its distinctive feature (814) is that it permits excision with a single application of the knife, while the base of the staphyloma can be properly managed. My operation is to be performed as follows: After careful fixation of the lower lid and upper lid, the surgeon pierces the enlarged cornea with a Bromfield's tenaculum, or a small hook such as I use for vascular ligature (815). He then grasps the handle of this instrument with his left hand, crossing it with his right hand holding the small shaping scalpel described elsewhere (816), introduces the knife at right angles and as far as possible at the lower edge of the staphyloma, pushing it forward to the middle of the tumor. He next passes it into the healthy tissue along the margins of the staphyloma, first upward and then downward and around in such a way that the incision ends at its starting point. Throughout the operation we must change the direction of the blade constantly, sometimes cutting a little deeper with it, and sometimes again withdrawing it a little. By means of the manoeuvre described we generally remove the diseased corneal tissue not only as planned, but also very quickly. At this point I shall not discuss the mode of treating the resultant wound, since the latter requires the application of exactly the same principles as those which govern direct treatment of the eye after cataract extraction (817). Complete cicatrization usually follows the operation, within two to three weeks at the latest.

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(810) See Article 260.

(811) See Article 265.

(812) See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 2, chapter 4, page 157.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, page 217.

(813) See Demours, l. c., volume 2, page 206, figures eleven to thirteen of table fourteen, and figure two of table sixty-four.

(814) See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut", l. c., page 16 (1816), page 15 (1817-1818), pages 16 et seq. (1819), and page 16 (1820).

(815) See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut", l. c., page 4 (1816).

(816) See the book by C. F. Graefe, "Rhinoplastik", l. c., pages 57 and 158, and figure seven of table five.

γ) Malignant adhesion staphylomata accompanied by pains and telangiectasias (818) have so far responded least to treatment. Neither pharmaceutical topica nor excisions of the cornea are of value in these circumstances. Both procedures always hasten transformation into frank cancer (819), even if the diseased area of the cornea is very circumscribed. We are therefore obliged to let this type of staphyloma strictly alone, or else to extirpate it together with the whole eye at an early date.

The first course is indicated it, where the protrusion of the cornea is moderate, the pain remains bearable and the advance of the disease is very slow. Such staphylomata are sometimes endured throughout life without any further trouble.

We follow the second course where the staphyloma, whether partial or total, grows steadily and is accompanied by deep burning pains or by transitory and excruciating stabbing pains. As regards the mode of extirpation, I feel that, in general, of the well known operations for enucleation (820), the following time-honored one deserves special commendation (821).

The very first step is fixation of the staphyloma by means of an instrument resembling an ordinary shoemaker's awl; this instrument is moderately curved, trilateral, and ground to a point in such a way that it is pushed right through the anterior half of the eyeball. As soon as the awl has pierced through, its handle is to be held firmly in the left hand. Next, the surgeon grasps the extirpator (822) - which has a blunt end and is curved only in front - in his right hand and inserts it under the upper lid in such a way that the concave side of the blade is directed against the anterior and upper wall of the eyeball. From there on the instrument must be pushed bodly between the eyeball and the orbit, the point must be pressed down hard at the optic nerve, this nerve must be severed as soon as possible, and, lastly, the eye must be cut clear around. In order to sever the soft parts quicker, during the circular section the physician must never neglect to make the knife cut irregu-

(817) See Article 272.
See the German translation of the English text of Bell, l. c., volume 1, page V.

(818) See Article 40.

(819) See the book by C. F. Graefe, "Angiectasie", l. c., page 29.

(820) See A. G. Richter, l. c., third edition, volume 3, page 414.
See Lefébure de Saint-Ildefont, l. c., page 196.
See J. G. Beer, l. c., 1792 edition, volume 2, page 310.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, page 230.
See Zang, l. c., part 2, page 281.

(821) See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut", l. c., page 16 (1816), page 16 (1819), and page 16 (1820).

(822) See the book by C. F. Graefe, "Angiectasie", l. c., page 88, and figures five and six of table three.

larly, sometimes a little less deeply, at other times again a little deeper.

The abovementioned fixation has the advantage of taking an unusually short time, and of permitting the eyeball to be turned with the greatest of ease in the different directions where it must be held, so that the precise region to be incised will always be held taut. It is also just as advantageous to sever the optic nerve right at the start; in this way we shall prevent any harmful tearing, increase the mobility of the eyeball, and at the same time essentially promote the quicker completion of the operation. There is one more point worth noting: after removal of the eyeball, all soft tissues surrounded by the periorbita are to be enucleated in toto with a pair of Cooper's scissors, even when they do not look suspicious; if they are allowed to remain, they can only do harm by causing fresh growths, since they bear the germ of cancer hidden in them. The outcome is seldom a disappointment, so far as saving life is concerned, if the complicated staphyloma is not accompanied by malignant dyscrasias. Unfortunately, however, the outcome is the opposite in two cases, even if we repeatedly evacuate the orbit right up to the osseous walls: where the disease arises from general causes which are incurable; or where the parts surrounding the eyeball have already suffered widespread scirrhous degeneration.

c) Treatment of corneal ulcers.

Article 263.

The methods for the treatment of corneal ulcers fall into two classes, causal treatment and direct treatment. We carry out the first type exactly as was indicated in the causal treatment of corneal opacities (823). As regards the second type, the following remarks must be added to what has been reported on this subject by other writers (824).

aa) Corneal ulcers due to inflammation (825) were cured partly by means of the remedies which destroy inflammatory corneal opacities (826), and partly by means of silver nitrate. Depending on the degree of sensitiveness present, I generally select from those drugs mild remedies on some occasions and stronger remedies on other occasions. In frank erethism, we prescribe mallow [Malva] decoction at first and a vinous solution of opium (827) later. In frank torpor, excellent results are obtained by painting the ulcer with a mixture of tincture of opium and Hoffmann's anodyne [spirit of ether] (828). Silver nitrate is indicated when ulcers, after all this, constantly become increasingly extensive, flocculent, and discolored, owing to excessive sluggishness. Many apply this caustic as a solid to the cornea, but this procedure often works harm because the silver nitrate does not reach the uneven base of the ulcer to a uniform extent, and because mechanical injury is very apt to result if the patient unexpectedly moves. I found that cautiously painting the ulcer with a concentrated solution (829) was much more beneficial in these circumstances. It is not unusual for an ulcer to diminish immediately after a single cauterization, but sometimes further applications must be carried out before improvement occurs. In the latter event, a fresh application of silver nitrate must never be made until the resultant irritation has completely disappeared. If the flocculent appearance goes away, if small red specks develop and are evenly distributed, if the margins of the ulcer become flatter and more regular, we terminate the course of treatment by painting the ulcer with pure alcoholic tincture of opium.

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(823) See Article 257.

(824) See Janin de Combe Blanche, l. c., page 345.
See A. G. Richter, l. c., third edition, volume 3, page 85.
See Lefébure de Saint-Ildefont, l. c., page 263.
See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 1, chapter 10, page 273.
See J. G. Beer, l. c., 1792 edition, volume 1, pages 328-329.
See G. J. Beer, l. c., 1813-1817 edition, several passages in volume 1 and volume 2.
See Demours, l. c., volume 1, pages 46, 270, and 282-283; and volume 3, pages 356, 359, and 362.

(825) See Article 42.

(826) See Article 259.

(827) See Article 259.

(828) See Article 259.

Article 264.

bb) I relied chiefly on concentrated hydrochloric acid for the treatment of ulcers due to resorption (830). Doctor Zitterland, in all his reports forwarded to me after my retirement from the army, praises this drug above all others (831). This acid is applied with a miniature brush exactly as described in the treatment of pannus-like degenerations (832). We know that improvement is under way when the surface of the ulcer loses its transparency and becomes moderately opaque, and when the margin of the ulcer appears both flatter and more regular. This type of treatment is always continued until the excavation evidences conspicuous shrinking, so that the process of resorption can advance no further. Only when shrinking has taken place is it perfectly safe to promote complete cicatrization by instillations of an aqueous solution of bichloride of mercury (833).

Chapter IV. Treatment of sequelae affecting the iris.

a) Treatment of synechia of the iris.

Article 265.

If the use of the eye suffers in no way from simple synechias of the iris (834), all treatment is superfluous. Only when vision is impaired by synechias of the iris must we intervene and create an artificial pupil.

In this article I have no intention of describing in detail the abovementioned operation originated by Cheselden, or the great advancement which it received at the hands of A. Schmidt (835) and of Scarpa (836), or several proposals and improvements suggested by other authorities (837) in this connection. Instead, I shall simply record the result of certain observations not without importance which I made at the bedside of patients.

(829) See Article 301.
(830) See Article 43.
(831) See the references quoted at the beginning of the previous article.
(832) See Article 255.
(833) See Article 291.
(834) See Article 45 and paragraph aa) of Article 172.
(835) See Schmidt, l. c., volume 2, pages 1-54, number 1, 1803.
(836) See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 2, chapter 16.
(837) See Janin de Combe Blanch, l. c., page 117.
See A. G. Richter, l. c., third edition, volume 3, page 365.
Footnote continued on page 192.

Many physicians proceed to perform coremorphosis without giving due thought to the minor details involved. Although this operation restores vision in the case of synechias of the iris, false cataract, circumscribed corneal opacities, or partial staphylomata, its indiscriminate use in the conditons named is by no means indicated on that ground. Only if those anomalies appear free from complications of any kind is benefit derived from this particular operation. If such anomalies are attended with complications, either all thought of coremorphosis must be abandoned, or the operation must not be performed until the complications have been eliminated to a sufficient degree. We take the first course in the presence of telangiectasias of the sclera, amaurosis completa, glaucoma, synchysis, buphthalmos, or deep exudations; such ocular defects are incurable, and even the slightest traumatic irritations are very apt to produce dangerous degenerations here. We choose the second course in the continued presence of marked vulnerability, dyscrasias, nervous disorders of the eyeball, lingering inflammations, blennorrhea, and other such diseases. If an artificial pupil is created before these complications have been eradicated, the operation is usually followed by copious exudations which make it impossible to restore vision, or by colliquative suppurations which destroy the entire eye.

Whenever Himly's method (838) of distortion of the pupillary margin was impossible of achievement, I found that, of the various methods of coremorphosis, corectomedialysis was most generally practicable. It proved to be particularly easy and reliable when a covered small ocular tenaculum was used. Throughout the past seven years the usefulness of this instrument has been demonstrated in a great many cases. It was utilized to good effect not only by skilled physicians but even by beginners. Its value was brought out best of all in the case of patients who would not hold still, where the operation would certainly have failed had it not been possible to adjust the tenaculum in the eyeball so that the instrument was active and passive ad libitum. Accordingly, when a patient was very restless the cover was slipped over the hook, and when a patient held still it was possible to complete the operation by releasing the hook. For both the construction of that instrument and its proper use I refer the reader, for the time being, to my own instructions (839), to the article by Jüngken in the Journal der practischen Heilkunde

(837) See the article by Himly in the Ophthalmologische Bibliothek, volume 3, pages 153-162, number 2, 1805-1807.
See the book by Langenbeck, "Neue Bibliothek für die Chirurgie und Ophthalmologie", volume 1, number 2; and volume 2, number 1.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, page 190.
See the article by Himly in the Bibliothek für Ophthalmologie, volume 1, pages 175-179, number 1, 1816.
See the monograph by Benedict, "De pupillae artificialis conformatione", l. c.
See Reisinger, l. c., page 22.
See the monograph by Wagner, "Commentatio de coremorphosi", l. c.
See Zang, l. c., part 2, pages 181-195.
See B. N. G. Schreger, l. c., pages 105 and 667.
See the article by Wagner in the Journal der Chirurgie und Augen-Heilkunde, volume 3, pages 113-165, number 1, 1822.

(838) See the article by Himly in the Bibliothek für Ophthalmologie, volume 1, pages 175-179, number 1, 1816.

(839) See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut", l. c., pages 4 and 16 (1816), and pages 4 and 16 (1819).

(840), to the thesis of Jüngken (841), and to the monograph on coremorphosis published by the same author (842).

The following remarks on the public controversies occasioned by this instrument need no longer be withheld. The essential feature of my invention consists in a covering of the ocular tenaculum. As soon as the idea of this cover was expressed and carried out, any skilled instrument maker could unquestionably construct the requisite mechanism in different ways. Such a possibility of infinite modifications, however, in no case justifies belittling the merit of the original specification. Several physicians (and precisely the bitterest opponents of my instrument, most surprisingly) have made the most varied attempts to copy my instrument after it had already been described in print for two, three, and several years, respectively. Here I shall make special mention of two of these officious plagiarists, Privy Councillor Langenback, and Schlagintweit.

Langenbeck, to whom a sample coreoncion was sent by Doctor Jungken (843) as far back as 1816, published an article on covering the ocular tenaculum in 1818; this article contains no hint that the instrument had been invented and manufactured long before than (844). Schlagintweit dreamt that he had discovered a new world when he attempted to change my instrument by adding a few strokes with the file! With ridiculous conceit, in his wild statements he makes mistakes which readily enabled even younger physicians to prove conclusively to him that he not only was immature, but also was obviously no respecter of truth (845). The worst of the matter is that no merit can be claimed for either of the two modifications, since they enable us neither to grasp the iris firmly enough nor to get close enough to the ciliary margin. Moreover, for my own part, I am far from believing that even the gold coreoncion with a double hook (which I utilize at present, and which indeed gives splendid results) is perfect (846). Every more delicate mechanism is always susceptible of being improved for its purpose. Certainly I shall always make both public and grateful acknowledgment of every such improvement, of every true improvement, no matter who achieves it.

One remark remains to be added to the general description of my method already available regarding the mode of incising the cornea for introduction of the coreon-

(840) See the article by Jüngken in the Journal der practischen Heilkunde, volume 46, pages 118-121, number 5, May, 1818.

(841) See the thesis of Jüngken, "Dissertatic inauguralis", l. c.

(842) See the monograph by Jüngken, "Das Coreoncion", l. c.

(843) See the article by Jüngken in the Leipziger Literatur-Zeitung, pages 955-960, number 120, May 15, 1819.
See the same article by Jüngken in the Allgemeine medizinische Annalen des neunzehnten Jahrhunderts, pages 455-464, number 4, April, 1819.

(844) See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut, l. c., 1816 volume.
See the thesis of Jüngken, "Dissertatio inauguralis", l. c.
See the monograph by Jüngken, "Das Coreoncion", l. c.
See the article by Langenbeck in the Neue Bibliothek für die Chirurgie, volume 1, pages 454-460, number 3, 1817.

(845) See the article by Wagner in the Archiv für medizinische Erfahrung, volume 1, pages 442-446, number 3, 1819.
See the article by Jüngken in the Leipziger Literatur-Zeitung, pages 955-960, number 120, May 15, 1819.
See the same article by Jüngken in the Allgemeine medizinische Annalen des neunzehnten Jahrhunderts, pages 455-464, number 4, April, 1819.

(846) See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut", l. c., pages 4 and 16 (1819).

cion, and of further treating the iris detached from the ciliary ring. I open the cornea by means of a small knife (847) which I likewise recommend for puncturing the eye. I attempt not only to incarcerate the piece of iris, detached from its peripheral attachment, in the external incision but [also], where it is at all possible, to draw the piece forward between the lips and to excise it close to them with a small pair of scissors having rounded ends (848).

It is not my intention to say more regarding the creation of artificial pupils here. I am waiting to discuss this branch of operative surgery (for which in its present ramification entirely separate discussions based on facts are constantly becoming more necessary) in a special paper, giving all the details which the seriousness of the subject demands.

b) Treatment of staphyloma of the iris.

Article 266.

Where small staphylomata of the iris (849) are due chiefly to corneal ulcers (850), treatment is directed primarily against the ulceration. All measures suitable for this purpose have already been discussed in the foregoing; I therefore refer readers to my earlier discussion for all data on this point (851).

Direct treatment is necessary where staphylomata of the iris, after becoming independent, constantly protrude farther, where heavy pressure makes them increase the resorption process in the cornea. -

Excellent services are rendered by painting with concentrated hydrochloric acid in counteracting simple myiocephala (852). Such staphylomata respond to this treatment in two ways. Either they recede until the pupillary margin fully recovers its normal form and only a small, slightly opaque spot is left upon the cornea. Or, in unfavorable cases, they are followed by round, smooth dots which are shiny black, surrounded by a small gray white corona, and accompanied by appreciable tearing of the pupil. -

In simple excrescences of wide area, all purely medicinal treatment is insufficient. Here it is necessary to excise the protruding part of the iris close to the cornea, and to brush concentrated hydrochloric acid over the diseased place regularly until complete cicatrization has taken place. Moreover, in these circumstances, even the most rational treatment can no longer prevent a helos from leaving behind it large black specks (surrounded by wide opaque coronae, and usually accompanied by amplyopia), and a racemose staphyloma or a melon from being followed not only be complete loss of vision but often by total collapse of the eyeball. -

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(847) See Article 245 and figure one of table five.
(848) See Articles 251 and 153, and figures ten and nineteen of table five.
(849) See Article 46.
See Janin de Combe Blanche, l. c., page 396.
See A. G. Richter, l. c., third edition, volume 3, chapter 8, page 358.
See J. G. Beer, l. c., 1792 edition, volume 2, page 350.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, pages 59 and 68.
See Demours, l. c., volume 1, page 300.
See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 2, chapter 1, page 3.
(850) See Article 46, 271.
(851) See Articles 263-264.
(852) See Article 255.

Where staphylomata of the iris are not simple but are complicated by telangiectasias of the sclera, by lasting pains deep in the eye, and by extraordinary sensitiveness of the whole eyeball, we must act to prevent their degeneration into true cancer of the eye. We must be guided by the same principles which I mentioned in connection with malignant staphyloma of the cornea, either leaving the staphyloma present entirely to nature, or removing it together with the whole eyeball (853).

c) Treatment of secondary blennorrhea of the iris.

Article 267.

In secondary blennorrhea of the iris, our major concern is with the location, and with the two different modes of origin of the anomaly.

As regards the first point, the physician must do everything which can, in general, check the advance of the disease into the inside of the eye. The first step in carrying out these directions for treatment of every case presenting this condition is to reduce, as much as possible, the materials generally indispensable to copious secretions. This is accomplished by means of a stricter diet (854), drastic venesection (855), and free use of local bloodletting (856). The result is either marked or insufficient improvement in the condition. In the case of more favorable results, no further assistance is required. When, however, the condition proves to be excessively stubborn, we at once apply silver-nitrate escharotics to the crown of the head (857) and immediately afterward we puncture the cornea (858). Even in the case of primary internal anomalies of secretion, those caustics recommended divert the pathologic irritation from the depth of the eye to remote parts at the surface (859). Corneal puncture, by procuring rapid evacuation, is the most direct means of preventing the reflex action which the discharged secretion produces in the eye (860).

As regards the different modes of genesis, we must note particularly whether the blennorrhea results from extension of the logado-blennorrhea, or from transmission of logado-blennorrhea purely by metastasis (861). -

Where it is a case of extension, we combat the condition with exactly the same measures which are helpful in ophthalmo-pyorrhea (862); obviously, a suitable reduction of the discharge of mucus within the conjunctiva is the surest way of halting its spread to the depth of the eye. If the iris becomes involved purely by metastasis, there are only two ways of stopping the disease. We employ means which are calculated to act on the body as a whole, or means which promote secretion in the palpebral conjunctiva without irritating the inner parts of the eye. This aim was achieved by the internal use of mild mercurous chloride combined with Digitalis purpurea, by the application of tepid poultices of henbane (Hyoscyamus niger) infusions to the eye, by instilling hot oil of almonds under the lids, and, in the presence of marked torpor, by gently painting the palpebral conjunctiva with a weak

(853) See Article 262.
(854) See Article 219.
(855) See Article 217.
(856) See Article 217.
(857) See Article 244.
(858) See Article 245.
(859) See Article 243.
(860) See Article 243.
(861) See Article 47.
(862) See Articles 243-245.

solution of caustic alkali (863). All topica which confine the power of secretion to the conjunctiva, particularly all kinds of collyria containing oxygen, are harmful when the disease is of metastatic origin.

The general directions already given in earlier articles (864) apply equally to secondary blennorrhea of the iris as regards everything pertaining to treatment based on form, and to removal of individual remote causes.

So long as the disease has not yet reached advanced stages (865), by strictly following the therapeutic directions mentioned we may expect a favorable outcome. On the contrary, where dtastic steps have not been taken at the start and blennorrhea of the iris has already reached more advanced stages, it is too late to save the eye (866).

Chapter V. Treatment of sequelae affecting the lens and the vitreous.

a) Treatment of cataract (867).

Article 268.

Up to the present time there has been but little advance in the medicinal treatment of cataract, on the whole. Very few of the many patients whom I treated by purely medicinal means were cured. An elderly man who suffered from siliquose cataract regained his vision by the use of belladonna instillations. In other words, these instillations dilated the pupil so much that the atrophied crystalline lens and the remnants of the capsule were entirely separated from the adjacent structures, so that the lens was suddenly depressed. As a result, the patient regained his sight completely and also, as a follow-up showed, permanently (868). Recent opacification affecting the lens (but not any other parts of the eye) was cured in two cases of syphilis by the use of corrosive sublimate. As the syphilis disappeared, transparency was restored to such an extent that, at the end of six

(863) See Article 302.

(864) See Article 195-227.

(865) See Article 47 and paragraph cc) of Article 172.

(866) See Article 47 and paragraph cc) of Article 172.

(867) See A. G. Richter, l. c., third edition, volume 3, page 190.
See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 2, chapter 2, page 38.
See Weidmann, l. c., volume 1, pages 109-130, number 1, 1802.
See von Siebold, l. c., volume 1, pages 187-191, number 1, 1802.
See the article by Himly in the Ophthalmologische Bibliothek, volume 3, pages 163-166, number 2, 1805-1807.
See Several passages in the magazine edited by Langenbeck, "Bibliothek für die Chirurgie", l. c.
See the book by P. F. von Walther, "Abhandlungen aus dem Gebiete der practischen Medizin", l. c., volume 1, page 3.
See the monograph by Benedict, "Monographie des grauen Staares", l. c.
See Demours, l. c., volume 1, page 496.
See Delpech, l. c., pages 293-322.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, page 279.
See Zang, l. c., part 2, page 195.
See Andreae, l. c., volume 1, pages 480-512, number 3; and pages 612-729, number 4, 1820.

(868) See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut", l. c., page 4 (1817-1818).

weeks, both patients recovered the use of their eyes.

The general thing to remember about recourse to operative surgery is that, of the many techniques recommended (869), the only ones always worth retaining as indispensable, essentially different procedures are extraction, discission, and couching. The following articles contain what I regard as noteworthy about these methods, on the basis of my own experience.

Article 269.

Extraction.

With but few exceptions (where discission is safer because the lens is perfectly soft or in a liquid state), extraction through the cornea is preferable whenever it is not absolutely contraindicated by reason of very special circumstances (870). Certainly the preference of many physicians for needle operations can be explained only on the ground that corneal section requires greater manual skill, which not everyone can command.

As regards the principles which govern extraction, I obey the ones that have gained greatest recognition. I feel that several changes should be made in the surgical appliances, in order to facilitate the execution of many manoeuvres (871).

α) Doctor Lachmann, in his book (872), gives an instructive description of cataract knives down to the present time. Beer's knife (873) would unquestionably be best suited to corneal incisions if it possessed certain features: if, while being pushed out, its point deviated toward the sclera less often; if, furthermore, while being introduced through the ocular chamber, it were not very apt to strike the iris; and if, thirdly, its cutting edge always detached the lower semicircle of the cornea soon enough. That deviation toward the sclera results because the very delicate, perfectly straight point of the instrument meets the anterior portion of the concave corneal suface at an angle of more than ninety degrees. The straight line of the blade is precisely to blame for the more frequent injuries to the iris. Lastly, the lower half of the cornea is severed too late because Beer's knife does not increase in width quickly enough for a larger cornea.

The defects mentioned render corneal section difficult in more than on respect. Where the point, while being pushed out, deviates toward the scleral margin, we must withdraw the point a little and repeat that manoeuvre while moderately depressing the handle toward the temporal region until the manoeuvre is more successful. Where fragments of iris protrude, we are obliged either to give up the attempt altogether, or to turn the point of the blade away from the iris toward the cornea, whereby the incision always proves to be too short. If the lower segment of the cornea is not cut through in time, we unavoidably injure the inner canthus as we continue pushing the knife.

In order to eliminate all the aforementioned bad features, I have the point of Beer's knife cured a little, and its body made wide enough. The curvature must be very slight, for otherwise the knife advances too fast. I found that the right curvature was obtained by having the straight surface of the blade assume a curve quite gradually one Paris line away from the tip, and by having the greatest degree of deviation at the extreme end equal exactly one quarter of a Paris line (874). Thanks to the modification recommended, with the concave surface averted from the iris, the instrument can be pushed on through the ocular chamber with two results. First, while being pushed out, its point touches the posterior wall of the cornea at more of a right angle, hence in a way which is by no means favorable to the abovementioned slipping toward the sclera. Secondly, gentle pressure by means of the small concave surface makes it possible to hold back the iris, if it protrudes, sufficiently until the knife emerges from the cornea. I found that the best width and length are given by dimensions where the broadest part of the blade amounts to exactly four Paris lines, and is situated neither more nor less than fourteen Paris lines away from the extreme point. Such knives, by a gradual increase in width, do not hinder introduction and, when properly used, they section the corneal flap long before their point reaches the inner canthus. [Translators' note: The Paris or French line is equivalent to 0.088814 inch.]

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(869) See B. N. G. Schreger, l. c., pages 256-300.

(870) See G. J. Beer, l. c., 1813-1817 edition, volume 2, pages 363 and 396. See page 628 of the article by Andreae, l. c., volume 1, pages 480-512, number 3; and pages 612-729, number 4, 1820.

(871) See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut", l. c., page 18 (1821).

(872) See Lachmann, l. c.

(873) See G. J. Beer, l. c., 1813-1817 edition, volume 2, page 46, and figure nineteen of table five.

In order that every aspect of these modifications (which have already received a thorough trial) may be clear to the reader, in table five I have included different views of a cataract knife such as I employ. Figure seven represents the natural size of the back; in it c. represents the starting point of the curvature, one Paris line distant from the tip a.; b. c. is a straight line drawn beside the back and shows us that a. b. is the deviation of the point, equal to one quarter of a Paris line. The curved instrument shown here is intended for operations on the left eye. Figure nine shows the opposite curvature, the one designed for the right eye. I had the latter illustration magnified four times in order to show how the deviation of the tip from the straight line a. c. must begin gradually at c., but must increase rapidly as the tip b. is approached. Figure eight illustrated the width and length of the blade, its tapering up to the point, and the shape of the handle. Here we note that the greatest width at a. b. equals four Paris lines, and the total length d. c. sixteen lines. The tapering of the cutting edge is evident from the fact that, when the back is perfectly straight, the abovementioned greatest width a. b. is exactly fourteen Paris lines away from the tip c. As regards the octagonal handle d. f., which is four Paris inches in length, its two widest surfaces run parallel to the surfaces of the knife, and its narrower surfaces to the edges of the knife. The one of the eight sides toward which the tip c. is bent must be identified by some sort of mark; in the sample knife under consideration, one designed for the right eye, the instrument maker indicated the side just mentioned, at e., by two small dots of a special color.

β) Instead of the customary two-edged needles for opening the capsule, I make use of analogous one-edged instruments equipped with a very short platelet. My reasons for this are given in Article 309, under the detailed explanation of figure seventeen of table five, which illustrates this instrument.

γ) Extractions of firmer capsule vestiges, for which (875) I likewise employ

(874) Note that these measurements, like all others, were most accurately computed from the Paris inch scale.

(875) See page 120 of the article by Jüngken in the Journal der practischen Heilkunde, volume 46, pages 118-121, number 5, May, 1818.
See page 100 of the article by Langenbeck in the Neue Bibliothek für die Chirurgie und Ophthalmologie, volume 4, pages 98-111, number 1, 1822.

my coreoncion in individual cases, are most successful, on an average, when suitable ocular pincettes are used. It must be remembered that straight forceps bend the corneal flap a good deal where the part of the cataract to be removed is badly situated. In order to prevent this, I have the anterior part (the part to be inserted in the eye) not only made very delicate, in general, but also curved in a definite way. The type of curve is evident from the full-sized illustration reproduced as figure fifteen of table five; this illustration, on the whole, gives a complete view of the surface of this instrument. If the pair of forceps is closed, the intervening space a. b. must be so small that the two blades together serve as a fine sound (round, smooth, somewhat curved) whose oval tip a. c. never measures more than one third of a Paris line. From b. to d. the blades grow appreciably larger, so that the entire slit a. d. gains sufficient firmness. Since, while in use, merely the anterior part of the pincette (which is only one quarter of a Paris line in diameter below the tip) rests between the corneal lips, the increased size below b. can do no harm. Figure twelve gives a side view of the forceps when open; a. and b. are two very thin prongs upon the inside of the oval tip which fit into small depressions directly opposite them when the blades are closed; c. shows the firm peg which protrudes inwardly right from one of the blades of the body of the forceps. The fine prongs give the forceps a better grip; the strong peg prevents the anterior ends from springing apart when pressed together. In all other respects the construction of the instrument recommended is sufficiently clear from the drawings of it, even without any further explanation.

Article 270.

Discussion.

All facts brought forward in an attempt to prove that this operation is older refer soley to corneal puncture; they by no means prove that incisions of the lens were performed earlier, with the proper technique, for the radical removal of cataract (876). Immediately after the animal experimentation carried out by Buchhorn at the suggestion of Reil (877), Langenbeck and I undertook to perform this operation for the first time on a human being in the year 1810 (878). Our observations led to a difference of opinion: Langenbeck believed that keratonyxis is indicated for almost all varieties of cataract (879); I regarded it as permissible only in selected cases (880). The latter viewpoint is supported by the findings of other physicians, particularly Himly (881), Beer (882), Demours (883), Zang (884), Andreae (885), Mon-

(876) See the article by Hecker in the Annalen der gesammten Medicin, volume 3, pages 341-356, number 4, January-June, 1810.
See Guillid, l. c., volume 1, page 19, number 1, 1819.

(877) See the article by C. F. Graefe in the Annalen der gesammten Medicin, volume 3, pages 357-366, number 4, January-June, 1810.

(878) See pages 360-361 of the article by C. F. Graefe in the Annalen der gesammten Medicin, volume 3, pages 357-366, number 4, January-June, 1810.

(879) See the book by Langenbeck, "Prüfung der Keratonyxis", l. c., page 3 of the preface.

(880) See pages 357-360 of the article by C. F. Graefe in the Annalen der gesammten Medicin, volume 3, pages 357-366, number 4, January-June, 1810.

(881) See pages 56-57 of the article by Himly in the Journal der practischen Heilkunde, volume 32, pages 30-70, number 2, February, 1811.

(882) See G. J. Beer, l. c., 1813-1817 edition, volume 2, pages 363-364, 398, and 402.

(883) See Demours, l. c., volume 1, page 538.

(884) See Zang, l. c., part 2, page 264

(885) See pages 503 and 685 of the article by Andreae, l. c., volume 1, pages 480-512, number 3; and pages 612-729, number 4, 1820.

Monfolcon (886), and Canella (887). Even now, after thirteen years of experience, my preference for discission is restricted to fluid cataract, particularly soft cataracts, and congenital cataract (888).

For this operation I at firat employed a needle with curved surfaces, two-edged in the two anterior thirds of the curve, but non-cutting in the posterior third. Doctor Spörl (889) gives a correct illustration of it, but Guillié (890) does not. I have recently become convinced that, when the pupil has been dilated by belladonna or Hyoscyamus, a small, delicate sickle is mot apt to render discission successful. The actual size of this instrument is represented by figure five of table five. The entire length of the sickle proper, from a. to b., amounts to exactly one Paris line. Both its concave margin and its convex margin have a cutting edge for two thirds of a Paris line, measuring from the tip, but the rest of the sickle is non-cutting. The blunt part is necessary in order to prevent any sharp part from remaining in the corneal incision when the cataract is incised directly behind the pupil. The sickle must be widest right in its middle, but not wider than one third of a Paris line. Any smaller instrument would lack the dimensions necessary for the creation of a proper cutting edge. The fine, delicate, perfectly round neck of the instrument begins just below b., and in the neck are inserted the surfaces and the cutting edges of the curved platelet; as c. is approached, the neck increases a little in size, though not very much. At c., five Paris lines away from the point a. and nine Paris lines distant from the handle d., the illustration shows a small crosspiece (at least warning beginners in the field of ophthalmology against inserting the instrument too far). The octagonal handle d. f. should be four Paris inches in length. Its two widest sides match the two surfaces of the sickle, and its two narrowest sides match the edges of the sickle. Of the smallest sides of the handle, the one which matches the convex edge of the sickle is indicated by a guide mark at e., so that, while the instrument is being withdrawn, it can be made to occupy the same position which it did while being introduced. -

The cataract sickle described differs from both Donegana's needle designed for coremorphosis and Langenbeck's keratome. Both have very long curvatures: the curvature of the keratome amounts to two Paris lines; the curvature of Donegana's small knife amounts to three Paris lines (891). The sickle portion of my needle, on the contrary, measures only one Paris line. Furthermore, Donegana has the convex edge made non-cutting and only the concave edge cutting, while Langenbeck has the concave edge made non-cutting and only the convex edge cutting; in the new sickle both edges are given the greatest degree of sharpness in the anterior two thirds. If discission is attempted with Langenbeck's instrument or Donegana's instrument, the cutting part remains between the corneal lips if the point of either is used close behind the pupil; the oftener that we now repeat the incisions for the purpose of adequate discission in this way, the more ways is the cornea injured, perforce. Apart from the fact that my needle, owing to its shorter curvature, obviates that difficulty, it secures still other advantages of no less importance. In other words, since this platelet cuts with both edges, we employ it sometimes as a convex knife and sometimes as a concave knife. Since it is curved, its hook portion makes it very easy to impale firm tags of capsule escaping section, so that they will be all the more sure of being incised later on. Now, since special techniques are required for cataract discission in almost every single case, and since the sickle recommended lends itself to many uses, it undeniably follows that discission by means of my sickle is most apt to ensure success.

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(886) See Monfolcon, l. c., page 5.
(887) See Canella, l. c.
(888) See Article 269.
(889) See Spörl, l. c.
(890) See Guillié, l. c., volume 1, figure five, number 1, 1819.
(891) See Langenbeck's explanation of figure four in the Neue Bibliothek für die Chirurgie und Ophthalmologie, volume 1, page 561, number 3, 1817.
See Donegana, l. c., page 136, and figure sixteen of table three.

Let me make the following remarks on how to introduce this instrument. It is grasped as if it were a quill pen, keeping the handle down, so that one surface of the sickle slants upward and the other downward, and the convex edge is turned away from the eye while the concave edge is turned toward the eye. While carefully maintaining the instrument in this position, the surgeon pushes it into the anterior ocular chamber right between the center and the periphery of the cornea. He then quickly applies it to the pupil and sections the cataract by means of the small convex cutting edge, making several transverse and lengthwise incisions. If larger pieces of cataract remain agglutinated after those incisions, we split them up partly with the convex edge of the sickle and partly with the concave edge. Where large vestiges of the capsule are not broken up by the manoeuvres described, because they conceal themselves behind the iris whenever the instrument is applied, they are impaled as close to their adhesions as possible. They are impaled upon the point of the sickle either from the front or, should this fail, from the back; the requisite discission is then carried out by means of a tug against the center of the pupil. Two points need no emphasis: 1- we do not resort to the last two more complicated techniques if the simpler techniques described earlier suffice; 2- the needle must always follow the movements of the eyeball and generally must be moved a little, in order to avoid producing either harmful pressure or bad tears in the cornea and iris. If the cataract has been broken up into sufficiently small pieces in accordance with the instructions given, the instrument is removed from the eye at the exact point where it was inserted, in order to obviate transverse sections of the cornea. The abovementioned guide mark upon the handle at e., shown in figure five, helps a great deal to obviate such sections. Were it not for this guide mark, as soon as the aqueous humor has turned opaque from the cataract fluid bathing it, we might easily miss the correct site while withdrawing the needle.

The process of resorption after discission sometimes takes place earlier, and sometimes takes place later. If marked improvement does not ensue within a fortnight, in these circumstances I repeat discission without further, perfectly useless delay, unless all operative surgery is contraindicated by signs of inflammation. In less favorable circumstances, after intervals of fourteen days keratonyxis is to be repeated twice and, in many cases, even three times. Only those types of cataract which respond perfectly to discission are completely cured by a single operation.

Article 271.

Couching.

This operation, according to my results, is to be performed only where extraction and discission appear to be ruled out by definite contraindications (892). Even in 1810 I performed depressio per corneam many times (893). Later investigations, however, showed that lenses which have been displaced from the axis of vision through the sclera are, as a rule, less apt to rise again. The main reason for this is that homogeneous cataracts, when subjected to prying movements, are depressed farther by instruments inserted directly in the posterior chamber than by instruments introduced through the cornea. In general, therefore, in this operation, once we have firmly decided that the operation is necessary, the scleral approach should be preferred to the corneal approach. Moreover, for both methods of couching I prefer to use my needle which I recommended for keratonyxis. I do so for two reasons: the crescent-shaped part of this needle, when placed flat against the anterior wall of the capsule, is more likely to make the lens give way; and discission of larger capsule tags, sometimes appearing even here, is easiest with the sickle point (894).

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(892) See pages 503, 631, 658, and 728 of the article by Andreae, l. c., volume 1, pages 480-512, number 3; and pages 612-729, number 4, 1820.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, pages 363 and 396.

Article 272.

Elsewhere I have already discussed the therapeutic procedure affording the proper management of traumatic inflammation developing after cataract operations (895). In the absence of dyscrasias (particularly concomitant arthritis), fomentations of cold water, when employed with due caution, were always most efficacious (896). In addition, however, the free use of venesection, when indicated, should never be neglected (897). Here I must add just one remark: although I have the eyes blocked off immediately after operation, I never follow the practice of Beer (898) and several others by having English sticking plaster used for that purpose. The plaster comes off then moist poultices are applied; if they are not applied, the plaster very soon becomes very wrinkled and at the same time reaches a degree of hardness which, owing to pressure, is not only troublesome but also harmful to the eye. We achieve this purpose much better by means of two narrow strips of linen coated with fresh emplastrum cerussae. When these are fastened diagonally from the eyebroa to the cheek, they are sufficiently firm even in the presence of moist poultices, they always remain soft, they never cause the least irritation, and they can be removed again easily even without being moistened first.

b) Treatment of glaucoma.

Article 273.

As regards the treatment of glaucoma, I must confess that, judging from my own experience, all the means customarily used to date have not been of the least help, indeed that in general they have done more harm than good. Although Beer's views (899) on the definite forms of glaucoma associated with cataract are worthy of great esteem, so far they have not advanced the treatment of glaucoma a single step.

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(893) See page 360 of the article by C. F. Graefe in the Annalen der gesammten Medicin, volume 3, pages 357-366, number 4, January-June, 1810.
See Sporl, l. c.

(894) See the book by C. F. Graefe, "Jahres-Berichte über das clinische chirurgisch-augenärztliche Institut", l. c., page 18 (1821).

(895) See the German translation of the English text of Bell, l. c., volume 1, pages IV-VI.

(896) See the German translation of the English text of Bell, l. c., volume 1, pages IV-VI.

(897) See the German translation of the English text of Bell, l. c., volume 1, pages IV-VI.

(898) See G. J. Beer, l. c., 1813-1817 edition, volume 2, page 378.

(899) See G. J. Beer, l. c., 1813-1817 edition, volume 1, page 581; and volume 2, pages 255 et seq.

Chapter VI. Treatment of retinal sequelae.

a) Treatment of independent photophobia.

Article 274.

If photophobia which is independent of other eye diseases stubbornly continues present (900), the following method is the surest way to combat it. -

Patients who are still strong are given suitable doses of pure substances which counteract sensitiveness and act specifically on the eye. Good services are rendered here particularly by doses of belladonna ranging from one quarter of a grain to half a grain, to be taken early and in the evening, if we simultaneously apply infusions made from the leaves of this plant once and even twice a day as a poultice to the lids for hours at a time. A few individuals who cannot tolerate belladonna find henbane [Hyoscyamus niger] helpful; I have them take from one to three grains of henbane syrup in powder form early and in the evening, and I simultaneously prescribe the regular application of fomentations composed of one drachm of the abovementioned preparation, two drachms of borax, and eight ounces of water. -

If increased sensitiveness is associated with appreciable weakness, we combine the internal use of the narcotics mentioned with moderately strong decoctions of Peruvian bark. -

If the patient is very weak, all narcotics must be ruled out. In the latter circumstances I found the following particularly beneficial: giving ocular vapor baths with sulphuric ether; washing the eye, the forehead, the temples, and the entire head with cold water; and prescribing the internal use of vinous infusions of Peruvian bark.

Apart from medicinal treatment, due regard for general health is likewise an important factor in hastening recovery. Here we cannot recommend certain measures warmly enough: exercise out of doors where the air is pure; nourishing and easily digestible food; temperate use of good wine; and the admission of evenly diffused light, which is to be increased gradually (901). In general, the last additional points to make are that: in independent photophobia drastic measures of all kinds are not of the slightest use; such photophobia is often quickly exacerbated to the point of photopsia and chromatopsia by any radical treatment; and improvement is effected solely by treatment which is conservative but continued steadily.

b) Treatment of amaurosis.

Article 275.

Unfortunately, up to the present we have made but little progress in the treatment of amaurosis. We can hope to cure it only when it is in a lower stage of development, is due to causes easily removed, and has not been present long. the general treatment of amaurosis is clearly expounded in the writings of Richter (902), of Himly (903), of Scarpa (904), of Kieser (905), and of Beer (906). Therefore the only point left for me to note is what special precautions the physician must observe in amaurosis caused by logado-blennorrhea (907).

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(900) See Article 50.

(901) See Articles 197-198, 279.

(902) See A. G. Richter, l. c., third edition, volume 3, pages 420-459.

The causal treatment depends on whether amaurosis is the result of severe exhaustion produced by hypersecretion, or the consequence of genuine metastasis occasioned by hyposecretion of mucus in the eye (908). In other words, we must accordingly restrict the power of secretion of the conjunctiva on some occasions, and stimulate it on other occasions. I have already fully explained how these two requirements are satisfied, in my article on the analogous treatment of secondary blennorrhea of the iris (909). With reference to that article let me say here simply that, in some patients with amblyopia and amaurosis, silver-nitrate escharotics applied to the crown of the head to draw the pathologic irritation away from the retina (910) effected the very same improvement which Larrey perceived in Egypt from the moxa in the same circumstances (911).

Direct treatment depends on whether amaurosis presents an erethistic or torpid tendency at the time of examination (912). Belladonna proved to be the best of the various ordinary remedies for erethistic amblyopia and amaurosis. Out of the entire group of drugs used in an attempt to counteract torpor of the retina, those which helped most (in the absence of concomitant congestions of blood toward the brain, and constipation) were camphor, arnica, and ammonia used both internally and externally.

We are justified in resorting to empirical treatment only when rational treatment directed against the cause and the form as prescribed proves inadequate. In this connection I believe that increasing doses of pulsatilla nigricans (913), mercurial ether as prescribed by Lafontaine (914), and washing the eyelids with strong Rhenish wine are entitled to special mention. Pulsatilla and the mercury preparation mentioned cured certain cases of incomplete amaurosis, whether erethistic or torpid, following blennorrhea as the result of exhaustion or metastasis. Although bathing the lids with wine as described never cured advanced cases, it was often of help when continued over a period of months in amblyopia. It was found best for the patient to moisten his eyelids for five minutes three times during the daytime with the corner of a clean handkerchief dipped in cold Rhenish wine, and on retiring to cover his lids with compresses of four thicknesses moistened with wine. Indiscriminate use of electricity and galvanism is dangerous; no matter how carefully they are applied to the eye, they are harmful in most cases. Out of a large number of victims of amaurosis, not a single one was cured by animal magnetism or by admitting concentrated sunlight to the depth of the eye. Where no manifest improvement results from the most trustworthy measures despite all caution, it is better to leave the eye entirely to nature, thus conserving its strength; by so doing even slight residual vision is always preserved far longer than when the patient submits to treatment which does not promise to restore the sensory life of the eye.

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(903) See the article by Himly in the Ophthalmologische Bibliothek, volume 2, pages 124-141, number 3, 1804.
(904) See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 2, chapter 8, page 220.
(905) See Kieser, l. c.
(906) See G. J. Beer, l. c., 1813-1817 edition, volume 2, pages 419-586.
(907) See Articles 49-51.
(908) See Article 51.
(909) See Article 267.
(910) See Articles 244, 267.
(911) See the book by Larrey, l. c., volume 1, page 208.
(912) See Article 51.
(913) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., page 69.
(914) See the book by C. F. Graefe, "Repertorium augenärztlicher Heilformeln", l. c., page 165.

Chapter VII. Treatment of sequelae developing in the central vascular system.

a) Treatment of hydrophthalmus.

Article 276.

Although both the pathologic and the therapeutic aspects of hydrophthalmus are in many ways identical with those of extension staphylomata (915), they are by no means identical in all ways. In extension staphylomata excessively large accumulations arise from diminished resistance on the part of the cornea; in them, therefore, increasing the cohesion of the cornea is the first consideration, and evacuating the ocular fluids is merely a secondary consideration (916). Hydrophthalmus always arises from an increase in secretion originally caused by pathologic activity of the central vascular system (917); its cure depends mainly on our seeking to restore normal conditions by means of proper treatment directed against the group of vessels involved.

If simple hydrophthalmus is merely in the lower [early] stages, we can still attempt to save the function or at least the shape of the eye by the following means: drastic laxatives; internal use of Digitalis purpurea, calomel, squill, and juniper berries; inunction of the orbital region with mercury; counter-irritation with silver nitrate (918); and opening the anterior chamber of the eye. In particular, the operation in question is to be performed in different ways, depending on whether the disease is more prevalent in the anterior or in the posterior part of the eyeball. In other words, paracentesis of the cornea alone sometimes suffices to counteract simple excess of aqueous humor (919). If the disease is seated in the vitreous humor, the crystalline lens must always be extracted (920) and simultaneously a portion of the vitreous body must be removed, after incision of the membrane of the plate-shaped fossette with a capsule needle (921), by means of moderate pressure on the eyeball as prescribed. In certain individuals both the former and the latter modes of evacuation were of radical assistance even without the intervention of manifest exudative or ulcerative processes. Accordingly, since the traumatic irritation associated with those operations sometimes destroys the seat of hydrophthalmus, even when the alteration is slight, we cannot by any means unconditionally recommend modes of treatment which perforce cause complete coalescence of the deeper structures in every case of hydrophthalmus, owing to exudation or suppuration (922). If the disease proves to be simple but reaches more advanced stages, if in particular the sense of sight is entirely lost, and if the corneal ectasia increases steadily in circumference despite the most efficacious treatment, we shall be well advised to excise the cornea early (923). Dangerous consequences appearing with further advances of the anomaly are thus prevented, and at the same time we create a stump whose form and size are unusually favorable for the insertion of artificial eyes. Not once did I see this procedure cause severe inflammations hard to restrict (924) or malignant degenerations. If many physicians have observed the contrary, probably circular excision has been undertaken during harmful complications.

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(915) See Articles 39, 261.
(916) See Article 261.
(917) See Article 52.
(918) See Article 244.
(919) See Article 245.
(920) See Article 269.
(921) See paragraph beta of Article 269, and Article 309.

Where hydrophthalmus is not simple but is accompanied by transitory stabbing pains, by boring pains in the eye, and by telangiectasias of the iris and sclera, we must abandon all attempts to restore vision or to preserve the shape of the eye. In these circumstances every irritation produced both chemically and mechanically hastens the development of cancerous metamorphosis. In such circumstances, therefore, it is absolutely essential that, in accordance with the rules which govern the treatment of malignant adhesion staphylomata (925), we either let the diseased organ strictly alone or enucleate the eye in toto early enough in the manner already described (926).

b) Treatment of atrophy of the eye.

Article 277.

In order to cure purely dynamic atrophy of the eye occasioned by trachoma (927) we attempt to increase the power of secretion of the central vascular system, just as we attempt to decrease it in all forms of hydrophthalmus (928).

Where the disease was not advanced and, moreover, conditions were otherwise favorable, residence in the country under clearer skies, a simple diet of nourishing and hearty food, and moderate use of the eye often proved beneficial. Furthermore, good effects were also obtained with a prescribed course of treatment including the drinking of milk fresh from the cow, the internal use of dyer's madder [Rubia tinctorum], the use of malt baths, the application of poultices of lukewarm milk to the eye for hours at a time, and oft repeated gentle friction of the forehead, temples, and entire head. Fomentations made with volatile acromatic vapors proved to be beneficial only when they increased the vitality without, however, producing marked external secretion; where these means occasioned marked excretions in the conjunctiva, the internal productivity was checked rather than increased. All remedies just recommended for the lower stages just as much as all others known to date remain absolutly powerless against the advanced stages of atrophy; here, as vision rapidly disappears, the eyeball sinks deeper and deeper into its socket, until the eyelids shrivel up and co-lapse over its shrunken vestiges.

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(922) See A. G. Richter, l. c., third edition, volume 3, chapter 2.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, pages 616-629.
See the book by Scarpa, "Trattato delle principali malattie degli occhi", l. c., volume 2, chapter 5.
See the German translation of the English text of Cooper, l. c., volume 2, page 427.

(923) See Articles 261-262.

(924) See Article 262.

(925) See Article 262.

(926) See Article 262.

(927) See Article 52.

(928) See Article 276.

Book six. Supplements.

Part one. Description of certain appliances designed for the use of eye patients.

Chapter I. Eyeshades.

Article 278.

Existing eyeshades are, for the most part, either inadequate or harmful. If pieces of green paper are selected for eyeshades, the shades lose their original shape on being used, even during the first few days. Pasteboard shades the eye too much in one place and its stiffness creates undesirable pressure, owing to the close fit. The shiny, varnished parchment eyeshades which can be bought are edged with thick iron wire; they are harmfui because they reflect light and are heavy; also, where idiosyncrasy exists, the resin content of their varnish is apt to produce erysipelatous inflammations fo the parts of the skin with which the shades remain in contact for any length of time. The surest way to avoid these evils is to have the shades constructed properly of "Spohnplatte" or of starched petty net. I have circular pieces ten inches in diameter cut out of both these materials, which are staples in millinery; these materials are elastic, transparent, and very light in weight. I fold the more elastic piece of starched petty net in two, and separate the stiffer piece of "Spohnplatte" into two equal parts. Every eyeshade frame made in this way from petty net or "Spohnplatte" consequently possesses one arched margin, one straight margin, and two corners. Both margins must be edged with a narrow band of twine interwoven with fine strands of wire (with the so-called wire ribbon of milliners). A ten-inch length of that wire ribbon is stitched on from corner to corner in such a way that the wire ribbon serves as crown to the straight margin of the frame; once the shade is put on, the crown makes it stay on. The crown can be made wider or narrower to suit individual requirements by running a longer or shorter piece of wire ribbon between these corners. After these instructions have been carried out, the last step is to cover the entire frame of the shade with thin green taffeta. We must always make sure that the taffeta is stretched evenly over the plate of "Spohn" or of petty net, and that the stitches are placed at the edges and by no means in just any direction upon the surfaces. Taffeta eyeshades of this kind never give rise to harmful light reflexes; they give enough shade but not too much in one place; they are not in the least irritating to the eye; they retain their original shape for a long time; and, because they are exceptionally light in weight, wearers are scarcely conscious of their presence. That is why their use has become more and more widespread in recent years, and why they are always kept in stock by many Berlin opticians. See also Article 198.

Chapter II. Gauge goggles.

Article 279.

With ordinary protective goggles fitted with circular pieces of glass, the glass is liable to steam up in cold weather (929). As I explained before (930), such goggles are apt to cause redness, hypersecretion, and even inflammation of the cornea, since they allow body heat and various gaseous effluvia to accumulate in the vicinity of the eye. Goggles like those shown in figure six of table five (though somewhat reduced in scale as illustrated) are, on the contrary, beneficial. Such goggles are made with a light strip of green leather, and with the so-called gauze capsules.

(929) See Article 193.
(930) See Article 193.

The strip of leather fits adults, as a rule, if it is given a length of eight Paris inches from a. to b. and a width of two and a quarter inches from c. to d., and if its openings necessary to receive the gauze capsules are separated between h. and l. by one and a quarter or one and a half inches. In order to keep the bridge of the nose free, even if edge c. or d. is turned under, the leather portion is cut out at e. and f. as shown. We attach a narrow piece of tape about ten inches long to each end, a. and b. When the goggles are put on, these strings are tied over the back of the head in a slip knot.

Let me describe the gauze capsules. The two tubes of the same size designed to hold the layers of gauze, labelled h. and l., are constructed out of very lightweight thin tin. They measure about one and a half Paris inches in diameter at the anterior part g. h., which has been out off straight. Their height is made to equal five lines on the nasal side, which is covered up at h. in the illustration, and ten lines on the temporal side from g. to i. Since the posterior part slopes from one side to the other because of that difference in height, its edge assumes an oval form. To ensure perfectly free movements of the eyelids under the protective goggles, the back part of the capsules is widened in such a way that the greatest diameter of their above-mentioned oval opening (which runs from one canthus to the other) measures one inch and ten lines, and the lesser diameter (which runs from the check to the forehead) measures one inch and seven lines. Moreover, each tube is composed of two separable pieces. The posterior tin cylinder k. i. is firmly attached to the leather by sewing through its perforated edge i., which is half a line in width and bent outward at a right angle. The anterior half k. g. must fit over the posterior half like the cover of a box, in such wise that after insertion of the gauze only main force will remove it. All parts made of tin are to be painted with black paint that adheres firmly but is absolutely not shiny.

In practice we lift off the anterior movable ring k. g., cover the posterior ring k. i. with one thickness of black gauze (931), and then press the former so hard over the latter that the cloth between the two rings (with some of its fine threads escaping at k.) is equally taut at all points. If a single disc of gauze admits too much light and air, two and even three layers may be inserted as described.

The advantage of gauze goggles is that they do not steam up in cold weather, that they do not allow body heat or various gaseous effluvia to accumulate at the eye (as already pointed out in Article 193), that they admit enough fresh air, that they prevent harsh contact in bad storms, and that they keep most dust out of the eye. If pieces of gauze wear out in the course of time, they can easily be replaced, since it is no trouble to carry a small supply of them with one.

Chapter III. Eye droppers.

Article 280.

In my book "Repertorium augenarztlicher Heilformeln" will be found a more detailed discussion of the various methods of applying to the conjunctiva drugs which are fluid and capable of forming drops (932). On many occasions I was convinced that treatment is unsuccessful because instillation is entrusted to inexperienced persons, who lack sufficient skill to manipulate the ordinary apparatus successfully (933). This fact prompted me to seek means by which instillations might in general be facilitated, by which they might even be performed correctly by persons of little skill. A glass vessel of the size shown in figure eleven of table five answered my purpose best; at the top it is shaped like a funnel, and at the bottom it terminates in a bluntly rounded tup with an opening like a hair. In order to use this dropper, we fill it half full, grasp its convex portion in the right hand between the middle finger and thumb, and press the index finger over the wide opening at the top. The fluid stays in the dropper as long as the funnel-shaped extremity is completely covered; at the instant when we admit air to it, one drop after another escapes from the hair-like outlet. Where patients are to receive not more than one drop, as soon as the first drop has escaped and even before the second can follow, we again press the index finger down hard upon the upper opening of the dropper. If the patient bends his head back while seated or reclining, if we then spread his lids apart a little at the inner canthus with the index finger and thumb of our left hand, and if the filled dropper held as directed is next brought within a few lines of the conjunctiva, instillation is carried out as swiftly as it is properly by removing the index finger from the funnel-shaped end.

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(931) See Article 193.

(932) See the book by C. F. Graefe, "Repertorium augenarztlicher Heilformeln", l. c., page 194.

Since the measuring of drugs for internal use drop by drop is likewise facilitated by this dropper, for several years now it has been kept on hand by certain apothecaries of Berlin.

A similar utensil has recently been brought out by Schuster glass fits into its upper opening; the fluid can be poured out drop by drop from the narrow spout *ad libitum*.

Both glass droppers are equally good for their purpose. The more recent and more complicated one, however, costs much more, and therefore is less calculated to come into widespread use in medicine.

Part two. Prescriptions.

Chapter I. Medicines for internal use.

Article 281.

Potio laxativa.

Rp.	Natri sulphurici	Unc. j.
	Aloës Soccetorin.	Gr. vji.
	Extracti hyoscyami	Gr. ji.
	Aquae foeniculi	Unc. vji.

M. s. Depending on the results, take half a cupful two to four times a day. See Articles 207 and 210.

Article 282

Pilulae aloëticae.

Rp.	Aloes Soccotorin.	Drachm. j.
	Saponis medicat.	Drachm β

M. f. l. a. pilulae No. 60., consperg. pulvere lycopod.

(934). It resembles a small glass pitcher; a stopper of ground

(933) See the book by C. F. Graefe, "Repertorium augenarztlicher Heilformein", l. c., page 194.

(934) See Schuster, l. c., volume 17, page 369, number 3.

S. Depending on the results, take from one to two pills one to three times a day. See Article 193.

Article 283.
Mixtura e sale ammoniaco.

Rp.	Ammonii muriatici	Drachm. i-ji.
	Extracti glycyrrhizae	Drachm. jii.
	Roob sambuci	Drachm. ji.
	Aquae sambuci	Unc. vi.

M. s. Take one tablespoonful every two hours. See Article 212.

Article 284.
Pulvis diaphoreticus.

Rp.	Opii puri	Gr. β.
	Camphorae	Gr. ij.
	Kali nitrici	Gr. v.
	Sacchari albi	Scrup. β.

M. f. pulv. S. Take before retiring. See Article 212.

Article 285.
Pulvis antarthriticus.

Rp.	Corticis Peruv. subtilias. pulverat.	Unc. j.
	Resinae guajaci nativ.	Drachm. iβ.
	Extracti aconiti	Scrup. β.
	Olei cajeput.	Drachm. j.

M. f. pulv. S. Take one heaping teaspoonful two to four times a day. See Article 214.

Article 286.
Solutio olei laurocerasi.

Rp.	Olei laurocerasi destill.	Guttul. j.
	solve ope sacchari albi suff. q. in aquae destillat.	Unc. ji.

S. Depending on the circumstances, take one tablespoonful two to four times a day. See Articles 207 and 222.

Article 287.
Pilulae ex hydrargyro muriatico corrosivo.

Rp.	Hydrargyri muriat. corros.	Gr. x.
	Micae panis albi. Sacchari albi.	ana Gr. xxx.
	Opii puri	Gr. v.

M. exactissime, f. l. a. c. aquae destill. s. q. pilulae No. LX. Consperg. pulvere lycopod.

S. Take from one to two pills three times a day. See Article 214.

Chapter II. Medicines for external use.

Article 288.
Tinctura opii ophthalmica.

Rp.	Opii electi comminuti	Unc. j.
	Vini Malacensis	Unc. v.

infunde et digere frequent. agit per horas xxiv, tum exprime, cola, post subsidentiam filtra.
S. nomine. See Articles 236, 247, 259, and 263.

Article 289.
Aqua ophthalmica vitriolata.

Rp.	Zinci sulphurici	Gr. j.
	Aquae rosarum	Drachm. iv.
	Tincturae opii ophthalm.	Scrup. j.

M. stent p. hor. 3., tum cola; s. nomine. See Articles 192, 236, 247, 255, 258, and 261.

Article 290.
Aqua ophthalmica divina.

Rp.	Lapidis divini Beerii	Gr. j.
	Aquae rosarum	Drachm. iv.
	Tinctura opii ophthalm.	Scrup. j.

M. stent p. hor. 3, tum cola, s. nomine. See Articles 192, 236, 247, 255 and 258.

Article 291.
Aqua ophthalmica mercurialis.

Rp.	Hydrargyri muriat. corrosiv.	Gr. j.
	Aquae rosarum	Unc. jii et Drachm. vji.
	Tincturae opii ophthalm.	Drachm. j.

M. stent p. hor. 3, tum cola et s. nomine. See Articles 233, 236, 247, 255, 258 and 264.

Article 292.
Collyrium mercuriale nigrum.

Rp.	Hydrargyri muriatici mitis subtil. pulverat.	Scrup. j.
	Aquae rosarum	Unc. j.
	Aquae calcis recens parat.	Unc. vi.

M. s. nomine. See Articles 240-241.

Article 293.
Collyrium belladonnae mercuriale.

Rp.	Foliorum belladonnae	Drachm. j-ji.
	digerant per horam j. in vase clauso cum suff. q. aquae fervid. ad colatur.	Unc. vji.
	adde	
	Aquae calcis recens parat.	Unc. vji.
	Hydrargyri muriat. mitis subtil. pulverat.	Scrup. j.

M. s. nomine. See Article 222.

Article 294.
Aqua camphorata Bateana.

Rp.	Vitriol. Romani Boli Armeniae	ana Unc. jv.
	Camphorae	Unc. j.

M. f. pulv. cujus Unc. j. affunde cum aquae bullientis libr. iv. amove ab igne ut subsideant faeces, cola, s. nomine.

In practice, depending on the circumstances, we use one drachm of the clear liquid mixed with two ounces of water partly for poultices on top of the lids, and partly for injections under the lids.

Most persons who are ignorant of the composition of Roman vitriol replace it by ferrous sulphate in the preparation of Bates's camphorated water. By so doing they obtain a totally different preparation because, on an average, after oft repeated tests, one hundred parts of Roman vitriol are found to contain sixty-five parts of ferrous sulphate and thirty-five parts of copper sulphate. For the preparation of Bates's collyrium, therefore, we must either select genuine Roman vitriol or use a compound of copper sulphate and ferrous sulphate in the preparations mentioned. As regards the method of preparation prescribed by Bates, I can excuse its being followed perhaps too punctiliously only in the imitation of approved formulas because, after repeated chemical analysis of the clear liquid, which is the only useful part, I discovered two things. First, the enormous amount of camphor served no purpose, since most of it was liberated with the sediment. Secondly, the addition of bole was of no appreciable influence in dissolving the vitriol, since, when the clear liquid was separated from the sediment, the entire amount of the Roman vitriol originally mixed in was recovered unchanged. In all probability, therefore, a much simpler and more uniform way of obtaining Bates's remedy would be: first, to grind together one scruple of Roman vitriol, eight grains of camphor, and a modicum of water until finely divided; then, to add to this eight ounces of boiling water; next, to filter the solution. See Article 242.

Article 295.

Aqua camphorata Schmidtii.

Rp.	Aquae destillat.	Unc. x.
	Zinci sulphurici	Scrup. j.
	Extracti saturni	Drachm. β.
	Spiritus vini camphorat.	Drachm. ji.

M. s. nomine.

Schmidt's collyrium is to be regarded as a mixture of zinc sulphate and zinc acetate in which the great preponderance of lead is precipitated as an insoluble product, lead sulphate, but perhaps that is precisely why it is efficacious. See Article 242.

Article 296.

Aqua saphirina.

Rp.	Aeruginis	Gr. jii.
	Ammonii muriatici	Drachm. β.
	Solve in aquae calcis recentiss.	Unc. v.

S. nomine. See Article 247.

Article 297.

Ceratum ophthalmicum.

Rp.	Olei amygdalarum dulcium recens express.	Unc. jii.
	Cerae albae	Unc. ji.

M. leni calori, fere refrigerat. agita in mortario, serva usui, s. nomine. See Articles 238-239.

Article 298.

Unguentum ophthalmicum Janini.

Rp.	Axungiae porci ope aquae rosarum lotae	Unc. β.
	Hydrargyri praecip. alb.	Drachm. j.
	Tutiae praeparat. Boli Armen.	ana Drachm. ji.

M. in mortario vitreo exactissime. S. nomine. See Article 239.

Article 299.

Unguentum de minio.

Rp.	Plumbi oxydati rubri puriss. subtil. pulverat.	Drachm. j.
	Unguenti rosati sine oleo rosarum parati	Unc. β.

M. exactissime, s. nomine. See Article 204.

Article 300.

Oleum nucum jugland, ammonitum.

Rp.	Liquor. ammonii caustici Pharmacop. Boruss.	Gutt. v.
	Olei nucum jugland.	Drachm. ji.

M. s. nomine. See Article 260.

Article 301.

Liquor argenti nitrici corrosivus.

Rp.	Argenti nitrici fusi	Drachm. β.
	Aquae destillat.	Scrup. j.

Solve s. nomine. See Articles 255 and 263.

Article 302.

Solutio cali caustici corrosiva.

Rp.	Liquoris cali caustici Ph. Boruss. Aquae rosarum	ana Scrup. j.

M. s. nomine. See Article 267.

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Part four. Explanation of the copper-plate illustrations.

Article 304.

The vignette upon the title page represents the Abu-Mandur convent, near Rosetta, along the bank of the Nile, built upon the ruins of the old Balbitine (935). Many Egyptians have made pilgrimages to the tomb of Abu-Mandur (revered as holy ground) in order to be cured of eye diseases of long standing by bathing their eyes with the water from a cistern situated there. See Article 234.

Article 305.

Table one (936).

Figure 1 shows how the palpebral conjunctiva looks in perfect health, when the lower lid is drawn down and everted (937). For further details see Article 7. Figure 2 depicts the changes produced by watering in the palpebral conjunctiva of the lower lid, which is drawn down and everted. For further details see Article 7.

Article 306.

Table two.

This shows the eyes sketched as they actually appear at the height of the discharge of pus. For further details see Article 22.

Article 307.

Table three.

Figure 1. Front view of fungous ectropion of the upper lid during protracted discharge of pus. See Articles 19, 23, 27.

Figure 2. Side view of fungous ectropion of the upper lid. See Articles 19, 23.

Article 308.

Table four.

Figure 1. Sketch of fungous ectropion affecting the upper lid and lower lid simultaneously. This picture gives a good idea of the nature of the granulation during the stage of regression. See Articles 19, 23, 27.

(935) See Denon, 1. c.

(936) A letter which I received from the Dutch ambassador to the cour of Prussia, von Perponcher (who held a command as major under Abercromby during the Anglo-Egyptian campaign), comments as follows on these illustrations: "I hasten to return the roll of pictures which you courteously sent me. Allow me to remark that I have found trachoma depicted with an accuracy and faithfulness that could not be improved on in the copper-plate illustrations entrusted to me. I myself was a victim of trachoma, and, unfortunately only too often, I witnessed its origin and advances in Egypt...
Berlin. April 8, 1823. (Signed) Perponcher."

(937) In order to avoid spoiling the effect of the illustrations, the figures in tables one to four are not given separate numbers; the figures read from top to bottom.

Figure 2. Sketch of fungous ectropion of the lower lid during protracted discharge of pus. The pathology is an exact reproduction of the engraving given by Vetch, in order to prove that the cases of trachoma observed by him in Egypt were identical with the ones which I described. See Articles 19, 23, 115.

Article 309.
Table five.

Figure 1. The knife recommended for paracentesis of the cornea. See Articles 245, 269.

Figure 2. Drawing of a cavalry shako, to illustrate how its construction is harmful to the eyes. See Articles 154, 178.

Figure 3. Eyelid retractor. This instrument resembles the Siegerist retractor for guiding the cataract needle knife. It differs from it only in the material selected, the cylindrical form, and the perfectly rounded tip. It is designed to evert the lids completely where we wish to examine the palpebral conjunctiva carefully, to cauterize it, or to excise it in the presence of sarcomatous ectropion. The anterior part a. c., rounded everywhere like a sound, is made of gold-plated silver because otherwise it is spoiled when corrosives are used. If we make the retractor stronger than the one whose actual size is illustrated, it is harder for it to grasp the outer skin of the eyelid. Weaker retractors bend if subjected to force sufficient to produce eversion. We note that between a. and b. the curved part has one convex side and one concave side. The part of the handle shown in the illustration, c. d., is four inches long.

Although we can use ordinary exploratory sounds or grooved sounds, there are objections to both. The former are too flexible, for the most part. The latter are harmful not only because their anterior part is not round enough, but also because the edges lying beside the groove press sharply into protruding parts of the lids if a false move is made.

In order to evert the lower lid, which is far easier to evert than the upper lid is, we have patients look straight upward while bending the head back a little. In this way the lower part of the palpebral conjunctiva is lifted up by means of the eyeball, and in consequence of that fact the entire lid is more inclined to be everted. If we wish to make merely a cursory examination of the inside of the lid, while the eyeball is in that position it is quite sufficient to draw down the outside of the lid gently by applying the index finger without recourse to any instruments. This manoeuvre effects eversions of the kind shown in table one.

If it becomes necessary to bring even the deeper part of the palpebral conjunctiva into view, or to fix the everted lid more firmly during the cauterization and excision of fungous growths, the above retractor is grasped in the right hand while the patient looks straight up. While the instrument is kept horizontal, the convex part a. b. is inserted under the tarsus from the outside right upon the eyelid. The convex part at the eyelid is gently moved in a downward direction so that the curve of the instrument presses the outer skin of the lid between the lower edge of the orbit and the eyeball into the orbit. That manoeuvre enables us to evert the palpebral conjunctiva for its entire extent up to the point where it meets the scleral conjunctiva. If the physician must have both hands free in order to perform the operation (as is the case particularly in excision and cauterization of fungous growths), the correctly placed retractor is entrusted to an assistant, who continues to apply the necessary pressure as already described.

In order to restore the lower lid to its normal position in the absence of sarcomatous ectropion, it usually suffices for the patient to make several attempts to draw his eyeball down after the hook has been removed. If those attempts fail to effect complete reposition, to complete it we need only use the index finger to press the tarsus gently from the cheek toward the eyeball during the abovementioned movements.

Eversions of the upper lid present greater difficulties than those of the lower lid. These difficulties are due largely to the more taut cartilaginous margin and to the prominence of the superciliary ridge. Eversion is best achieved here in the following way. First, we have the eyeball turned down as far as possible. Next, we cautiously grasp the upper row of cilia with the thumb and index finger of the left hand in order to turn the tarsus well away from the eyeball. Then, with the right hand, we place the anterior third of the convex part of the hook (held horizontal) a few lines behind the palpebral margin against the outer skin; we press the convex part downward against the eyeball while the cilia are drawn upward simultaneously. As soon as the tarsus has been everted, the whold eyelid readily follows if the physician draws the cilia farther and farther upward while the patient keeps on looking down. The points noted as essential in keeping the lower lid everted during cauterizing or excision apply here, too. If we wish to effect reposition of the everted upper lid, the patient must look straight up, and the physician must draw the tarsus down by grasping the eyelashes or by gently pushing the tarsus down from the eyebrow with the hook while keeping the skin of the forehead fairly taut. See also Articles 247, 252.

Figure 4. An infantry shako. See Articles 154, 178.

Figure 5. The sickle needle for cataract discission. See Article 270.

Figure 6. A pair of gauze goggles for protecting the eyes. See Article 279.

Figures 7, 8, and 9. Diagrams to explain the construction of the cataract knife. See paragraph alpha of Article 269.

Figure 10 shows the actual size of the scissors designed for the excision of sarcomatous ectropion and of the palpebral margin. The blades are spread apart, so that their rounded ends may be seen. Figure 19 gives another view of them, showing the degree of curvature and the size of the blades. See Articles 251, 253.

Figure 11. Eye dropper. See Article 280.

Figure 12. Side view of the cataract pincette. Its curvature is seen from Figure 15. See also paragraph gamma of Article 269.

Figure 13 shows the actual size of the hook pincette used for excision of the palpebral margin. Since the pincette is open, the size of its blades may be perceived fairly well. In order to show clearly how the hooks fit into each other, I had them enlarged in Figure 21. Apart from the fact that the pincette is to be made exactly the same size as in Figure 13, so that the surgeon may grasp the eyelid firmly enough, this instrument is identical with Bloemer's pincette (938). See Article 253.

Figure 14. Entropion forceps, shown in actual size. Both legs are shaped like a sickle at the tip, from a. to b. and c. to d. These parts must be strong, for otherwise they allow the incarcerated piece of skin to escape. Here, however, to avoid concealing too much of the fold of skin, their surfaces which come together may be no means be given breadth. We strike a happy medium by means of the following device. Each sickle end has three sides: the top is oblique, the inside is grooved, and the outside is convex. In the case of the left leg we can see the smooth upper surface extending from the concave margin to the convex margin between a. and b., and also the rough inner surface between e. and f. In the case of the right leg of the forceps the convex outer surface is visible for its full length between c. and d. In order that the structure of the three surfaces in both legs

(938) See Bloemer, l. c., page 730 and Figures nine and ten of table five.

might be viewed simultaneously, I arranged for the cross-section diagram *g*. *h*. *i*. *k*. *l*. visible beside the sickle portion. It shows how the slanting upper margins *g*. and *h*. are opposite each other, forming a hollow when the pair of forceps is closed. It shows how the rough sides at *l*. meet exactly when the forceps are closed, and how the convex surfaces *i*. and *k*. extend clear around the outside.

It must also be recalled that both the sickle ends, *a*. and *c*., slope inward a little. In other words, the legs must be exactly one Paris line apart at *a*. and *c*. if the inner surfaces of the instrument meet at the extremities *b*. and *d*. Thus, when the instrument is closed, the intervening piece of skin is incarcerated much more uniformly than it could be if the legs diverged without interruption. This instrument makes it easy for us to hold the outer skin of the lid from across the bridge of the nose as well as from the temples. With it we can accomplish fixation of this skin precisely in a refular pointed oval, consequently in the very form that must be excised from it. If the little fold of skin between the closed forceps over-rides the surfaces *g*. *h*., we can decrease the pressure and very gently use our fingertips or, if necessary, an ordinary pincette to draw the skin out more or to push it back (depending on whether a larger or a smaller area of skin is to be removed). Where unusually small pieces of skin must be excised because of definitely partial entropion, the physician uses the tips *b*. and *d*. instead of the middle of the convex margin of the forcepa. In order to apply sufficient pressure to prevent the fold of skin from escaping, we place the restraining finger not far from the sickle portion at the body of the forceps. After accurate and firm fixation of the fold of skin with one hand, the other hand is used to insert the open scissors (Figure 10) under the sickle portion, and the cutting instrument with its concave surface is applied in such a way that this concave surface almost touches the convex edge of the sickle. During the cutting process the scissors must never swerve from the convex edge, which can now be used as a guide.

We have only to compare the simple instrument recommended with similar devices known to date (939) to be convinced that it is superior to others designed for the same purpose (partly because they are faultily constructed in every respect, partly because they have the wrong shape), and that this instrument likewise dispenses with the tedious and annoying use of two special palpebral forceps. See also Article 253.

Figure 15. View of the surface of the cataract pincette shown in Figure 12. See paragraph gamma of Article 269.

Figure 16. Shape of a piece of cardboard used as support to protect the eyeball during cauterization. See Article 252.

Figure 17. The needle for opening the capsule in extractions. Ordinary lancet-shaped needles customarily used for opening the capsule leave a great deal to be desired. -

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(939) See J. G. Beer, l. c., 1792 edition, volume 1, pages 50, 403, and 407; Figures one and two of table one; and Figure seventeen of table two.
See G. J. Beer, l. c., 1813-1817 edition, volume 2, page 114; and Figure one of table five.
See Bayer, l. c., page 57; and Figures one, two, and three.
See the book by Helling, "Praktisches Handbuch der Augenkrankheiten", l. c., volume 1, page 312, and Figure seven.
See Figure two of the article by Langenbeck in the Neue Bibliothek fur die Chirurgie, volume 1, pages 415-428, number 3, 1817.

It is hard to indroduce those needles (owing to their being two-edged) without injuring the cornea in some way wherever the lips of the wound are in complete apposition after an eminently successful incision. In other words, if the surgeon applies the lancet part to the eyeball, the cutting edges repeatedly tear the cornea before they glide into the delicate, often invisible aperture. Although, in order to avoid this evil, we must first press the round part of the needle (located behind the cutting edge) between the corneal lips, and then guide the anterior cutting part into the incision, the manoeuvre recommended (apart from the fact that we can hardly perform it on eyes turned inward) always occasions friction of the lips of the wound, owing to moving the instrument back and forth, and undesirably prolongs the operation. Moreover, still another objection to those needles is that their small plate is made too long. Since in this way the posterior sharp lancet end is still between the corneal lips when the tip has long since reached the crystalline lens, the margins of the corneal incision perforce are nicked all the oftener and deeper as the instrument is moved oftener and harder in different directions in order to open the capsule.

The needles which I have used for many years in incision of the capsule have the following construction: I have the oval platelet a. b. c. (the actual size of which is shown in Figure seventeen of table five) made so that its length never exceeds one and a third Paris lines, and its width never exceeds one third of a Paris line. From b. to d. this instrument must fit into the completely blunt part, which is between twelve and fourteen Paris lines in length and perfectly round in all parts. The margin of the platelet a. b. forms a complete cutting edge for its entire length, but its margin a. c. is sharp only from a. to e. (only as far as the formation of the tip requires it), and moreover is completely round between e. and c. The handle (which in the illustration is broken off at f.) is made four inches in length. It is purely octagonal and attached in such a way that its two widest surfaces correspond to the two surfaces of the needle, while its two narrowest surfaces correspond to the edges of the needle. In order to make it plain which of its narrow sides matches the blunt edge e. c., the side in question is given some distinguishing mark. Needles of this type possess two advantages. They enter the corneal incision with the back of the platelet e. c. pressed gently against the corneal margin without stopping or causing secondary injuries. They enable capsular section, during which only their round part rests between the corneal lips, to be performed with an unusual degree of safety. See paragraph beta of Article 269.

Figure 18. Handle of the cautery iron used for cauterization of the inside of the lid. Figure 20 goes with this. See also Article 252.

Figure 19. Side view of the scissors shown in Figure 10 for excision of the palpebral margin. See Articles 251-253.

Figure 20. A cautery iron requisite for cauterization of the inside of the lid; its handle is shown in Figure 18. See Article 252.

Figure 21. Enlargement of the broken off ends of the hook forceps. Compare with this also the explanation of Figure 13.

Name index (authors and other persons).

Abercromby (Lieutenant-General) Articles 115, 305
Adams Articles 63, 68, 69, 70, 72, 73, 105, 110, 114, 116, 208, 245, 251, 252, 261
Aegina See Paul of Aegina
Aetius of Amida Articles 108, 207, 212, 224, 251
Alcmarianus See Forestus Alcmarianus
Alexander I. (the Emperor of Russia) Articles 71, 73
Alexander of Tralles Articles 108, 218
Alpini Articles 110, 130, 181, 194, 207, 217, 234, 244
Amida See Aetinus of Amida
Andernacus (translator) See Alexander of Tralles and Paul of Aegina
Andreae Articles 268, 269, 270, 271
Arneman Article 252
Assalini Articles 64, 71, 72, 111, 112, 113, 114, 133, 138, 141, 153, 160, 176, 193, 194, 217, 221, 223, 235, 236
Atkinson Article 133
Augustin Articles 187, 188, 192, 201
Avicenna Articles 109, 180, 217

Baglivi Article 131
Baltz Articles 64, 133, 160, 194, 234
Barclay de Tolly (General) Article 124
Baricellus Article 68
Bartolozzi Article 218
Bates Articles 242, 294
Bayer Article 309
Beer, G. J. Articles 98, 100, 103, 104, 105 147, 251, 252, 253, 255, 257, 262, 263, 265, 266, 268, 269, 270, 271, 272, 273, 275, 276, 309
Beer, J. G. Articles 97, 100, 101, 104, 139, 252, 254, 262, 263, 266, 309
Begue de Presle (translator) See Monro
Bell Articles 262, 272
Benedict Articles 265, 268
Bloemer Articles 253, 255, 309
Boerhaave Article 194
Bongiovanni Articles 117, 119, 138, 194, 207, 224, 234, 236
Bose Article 103
Brandis Article 73
Brera (editor) See Penada Article 131
  Scarpa Articles 68, 117, 118, 193, 208 217, 218, 224, 242
Brigges Articles 63, 67, 115, 133, 207 224, 234
Bromfield Article 262

Bruant Articles 181, 194, 208
Bruce Article 111
Buchorn Article 270
Buchner (editor) See Schuster
Büttner (Staff Surgeon General) Article 239

de Candolle Article 235
Canella Article 270
Celsus Articles 107, 194, 203, 207, 212, 217, 219, 224, 227, 252

Chamseru Articles 64, 71, 111, 133, 138, 176, 194

Chauliac See Guy de Chauliac
Chaussier Article 105
Cheselden Article 265
Cimba Article 119
Colla Article 119
Combe Blanche See Janin de Combe Blanche
Condolle See de Candolle
Cooper Articles 252, 253, 262, 276
Cornarius (translator) See Galen
Crawford Article 211
Cumming Article 234
Cyrus (the Younger, 424-401 B. C.) Article 106

Delpech Article 268
Demours Articles 159, 252, 253, 254, 255, 257, 262, 263, 266, 268, 270

Denon Articles 234, 304
Desaix Articles 113, 130
Desessartz See Chamseru
Desgenettes Articles 73, 150
Donegana Article 270
Dumont Article 262
Dunglison Article 261
Edmonstone Articles 63, 68, 71, 111, 133, 217
Ehrhart (editor) See Faxe, Frolich, Gadelius, Hellstrom, Kewenster, and Rudolphi

Fabri (editor) See Stroll
Farrel Articles 71, 115, 194, 217, 218 235, 236, 245

Faxe Article 125
Fischer (Physician-in-Chief) Articles 73, 88, 137
Fischer, C. T. Articles 133, 160, 194
Foesius (translator) See Hippocrates
Forestus Alcmarianus Articles 68, 131
Fourcroy Articles 9, 61
Frank Articles 111, 131, 133, 137, 138, 142, 148, 150, 153, 160, 176, 179, 180, 193, 194, 206, 218, 222, 223, 224, 227, 235, 238
Friedrich Wilhelm III. (the King of Prussia) Forward

Frölich Articles 71, 207
Froriep (translator) See Cooper

Gadelium Article 125
Galen Articles 68, 107, 194, 203, 207, 217, 218, 224, 227

Gibolin (translator) See Priestley
Gorraeus Article 74
de Gorris See Gorraeus
Graefe Articles 52, 63, 73, 75, 83, 180, 182, 187, 188, 192, 201, 205, 206, 207, 222, 226, 229, 234, 235, 238, 239, 241, 244, 247, 252, 253, 255, 257, 258, 260, 261, 262, 265, 268, 269, 270, 271, 272, 275, 280

Gregor See Macgregor
Grein (artist) Articles 7, 70
Gruithuisen Article 62
Günther Articles 63, 69, 70, 115, 116, 133, 192, 208, 245, 251

Guillié Article 270
Guy de Chauliac Article 252

Harcke Article 139
Harles (editor) See Jungken Articles 265
Hecker Article 270
Helling Articles 64, 133, 160, 194, 309
Hellström Articles 71, 207
Himly Articles 265, 268, 270, 275
Hippocrates Articles 74, 106, 107, 109, 130, 150, 194, 203, 207, 217, 224, 227, 244, 252

Hoffmann Articles 103, 259, 263
Horn (editor) See Schlagintweit and Wagner Article 265
Hufeland Article 139
Hutchison See Atkinson

Jacobson Article 52
Jäger Article 253
Janin de Combe Blanche Articles 239, 252, 254, 262, 263, 265, 266, 298

John (Professor) Article 235
Jourdan Articles 103, 105, 252
Jüngken Articles 255, 265, 269
Jung Article 252

Kewenster Article 125
Kieser Articles 51, 275
Kluyskens Articles 111, 125, 126, 133, 160 194, 217, 234

von Koenen (Privy Councillor) Article 73
Kosmely (translator) See Bell
Kranz (Prussian regimental surgeon) Article 126

Kutchkovsky	Article 133
Lachmann	Article 269
Lafontaine	Article 275
Langenbeck	Articles 265, 268, 269, 270, 309
Lanzoni	Article 217
Lara See Narbonne-Lara	
Larrey	Articles 64, 111, 112, 113, 114, 115, 133, 137, 140, 150, 153, 160, 180, 194, 236, 238, 275
Lassus See Chamseru	
Lefébure de Saint-Ildefont	Articles 97, 98, 101, 103, 252, 255, 257, 262, 263
Lehmann	Articles 133, 160, 194
Lestocq (General)	Article 124
Lipsius	Article 178
Loeffler	Article 234
Luce	Article 252
Mcdonald (Marshal of France)	Article 124
Macgregor	Articles 62, 63, 67, 68, 71, 105, 111, 115, 116, 194, 242
Marescotti	Articles 117, 119, 138, 194, 207, 218, 236
Maurice de Saxe See de Saxe	
Mayer (Professor)	Article 219
Menu (General)	Article 179
Mercurialis	Article 68
Meroni (translator) See Adams	
Michaelis (translator) See Vetch	
Monfolcon	Article 270
Mongiardina	Articles 63, 117, 119, 133, 218
Monro	Articles 131, 179, 193
Montano (translator) See Aetius of Amida	
Muller	Article 69
Münstermann (Aulic Councillor)	Article 126
Naegele (Professor)	Article 126
Napoleon	Articles 111, 112, 117, 119, 124, 125, 126, 128, 129
Narbonne-Lara (Governor of Torgau)	Article 73
Ney (Marshal)	Article 124
Oelenschläger (Chief Staff Surgeon)	Article 70
Olivier	Articles 111, 133, 138, 148, 153
Omodei	Articles 63, 68, 71, 115, 116, 117, 118, 119, 131, 133, 138, 194, 207, 217, 218, 223, 224, 226, 227, 234, 235, 236, 242, 245
Pallas	Article 193
Paré	Article 252

Paul of Aegina	Articles 108, 224, 252
Penada	Articles 117, 119, 131, 194, 217
Percy	Article 252
Perlep (translator) See de Candolle	
Perponcher	Article 305
Pierer (editor) See Jungken and Langenbeck	Article 265
Plummer	Article 214
Potter	Article 178
de Presle (translator) See Monro	
Priestley	Article 148
Pugnet	Article 224
Rambach 9translator) See Potter	
Réaumur	Article 202
Reid	Article 217
Reil	Articles 62, 73, 75, 84, 100, 103, 104, 137,205, 270
Reisinger	Article 265
Reyland (Professor)	Article 126
Rhazes	Articles 68, 109
von Ribbentrop	Articles 137, 192
Richter, A. G.	Articles 103, 159, 252, 253, 254, 255, 257, 262, 263, 265, 266, 268, 275, 276
Richter, G. A.	Articles 73, 182, 188
Riffart	Article 222
Rima	Articles 63, 67, 118
Rincolini (translator) See Frank	
Riva di Trento See Canella	
Royston	Articles 63, 133
Rudolphi	Articles 71, 125
Rust	Article 194
Saint-Ildefont See Lefébure de Saint-Ildefont	
Saunders	Article 194
Savaresi	Article 111
de Saxe, Maurice (Marshal of France, 1696-1750)	Article 179
Scarpa	Articles 68, 117, 118, 193, 194, 208, 217, 218, 224, 239, 242, 252, 253, 254, 255, 257, 262, 263, 265, 266, 268, 275, 276
Schlagintweit	Article 265
Schmidt	Articles 51, 97, 101, 103, 104, 105, 239, 242, 249, 252, 265, 295
Schreger, B. N. G.	Articles 253, 265, 268
Schreger, C. H. T.	Article 74
Schuster	Article 280
Sennert	Article 68
von Siebold	Article 268
Siegerist	Article 309
Soemmerring	Article 4
Spörl	Article 270
Stoll	Article 131
Sydenham	Article 256

Tauentzien (Count von Wittenberg) Articles 73, 124
de Tolly See Barclay de Tolly
Tralles See Alexander of Tralles
Trallianus See Alexander of Tralles
Trento See Canella

Vasani Articles 63, 67, 68, 117, 118, 119, 133, 160, 194, 207, 212, 217, 218, 219, 222, 226
Vauquelin Articles 9, 61, 176, 222.
Vetch Articles 23, 63, 67, 68, 71, 111, 115, 116, 133, 141, 142, 143, 144, 145, 160, 192, 194, 207, 208, 217, 218, 219, 222, 223, 234, 236, 242, 251, 308
Vogel (editor) See Loeffler
Volney Articles 71, 110, 111, 133

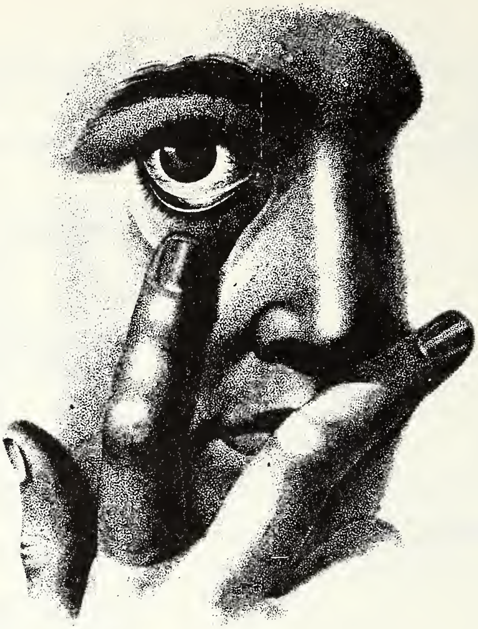
Wagner Article 265
von Walther Articles 54, 61, 87, 100, 101, 103, 137, 139, 142, 147, 151, 176, 182, 219, 222, 235, 268
Wardrop Articles 218, 245
Ware Articles 72, 105, 115, 116, 131, 145, 151, 217, 223, 236, 242
Wedekind Articles 115, 116
Wegler (Councillor of State) Articles 73, 88, 137
Weidmann Article 268
Weinhold Article 234
Weller Article 253
Wells (translator) See Jacobson
White Article 181
Whyte Article 111
Wiebe (medical officer of the battalion at Arnswalde)
Wiebel (Staff Surgeon General) Article 70
von Wittenberg See Tauentzien

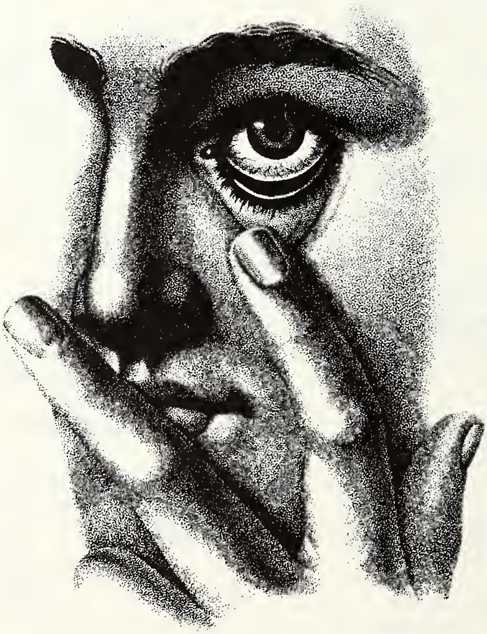
Xenophon Articles 106, 129, 136, 193

York (General) Articles 122, 124

Zang Articles 262, 265, 268, 270
Ziermann Articles 116, 133, 160, 194
Zitterland (Physician-in-Chief to the King of Prussia Forward, Articles 126, 145, 179, 264

Tabula Prima





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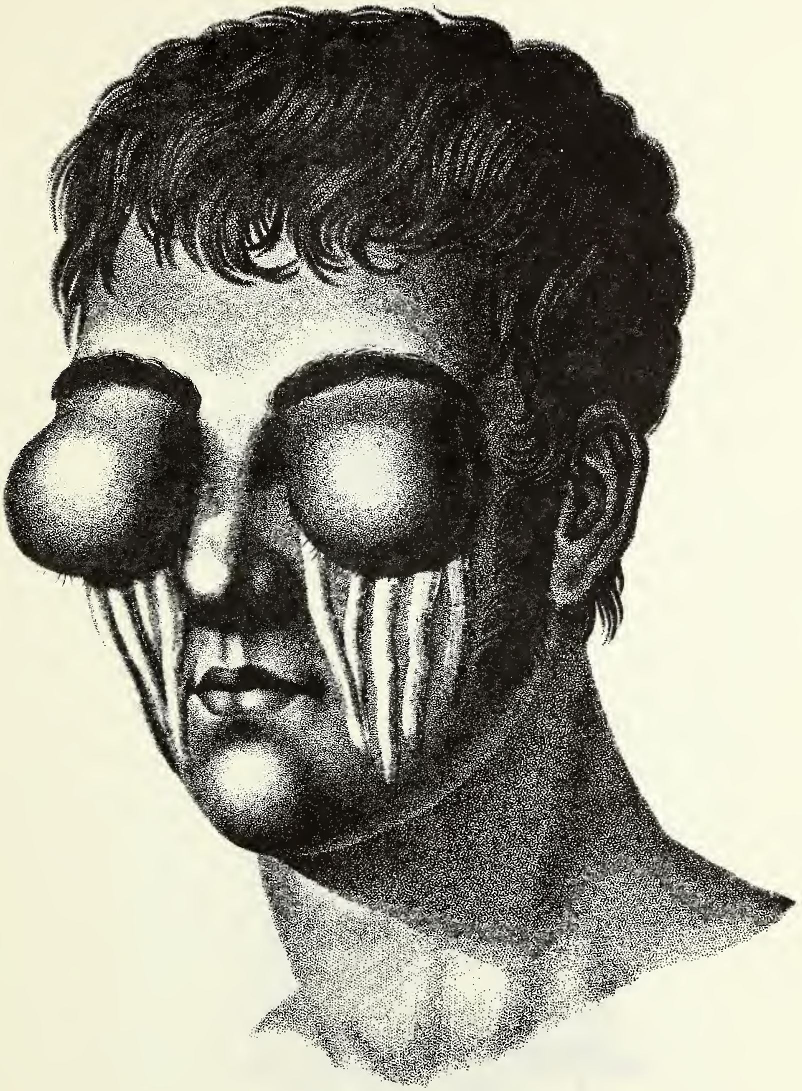

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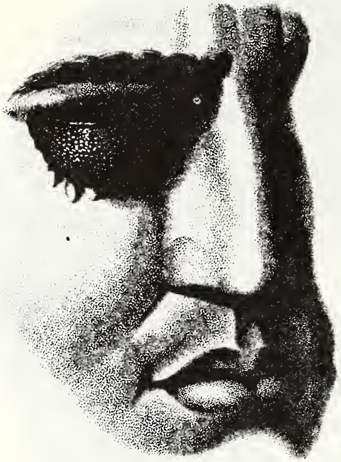
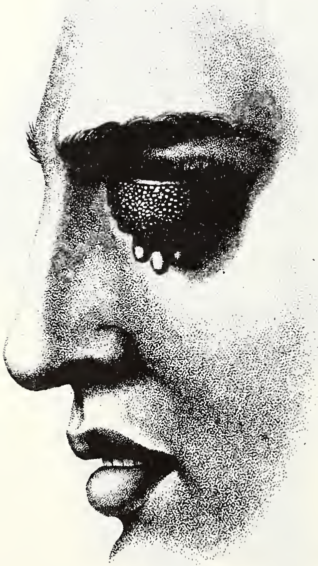
Tabula Tertia





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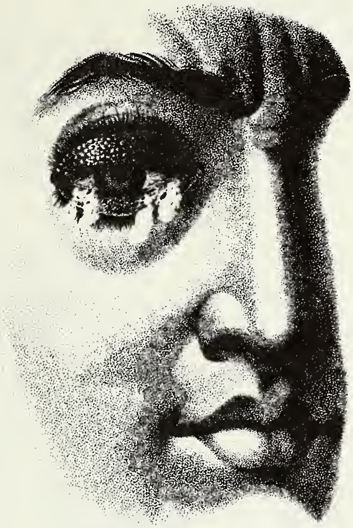

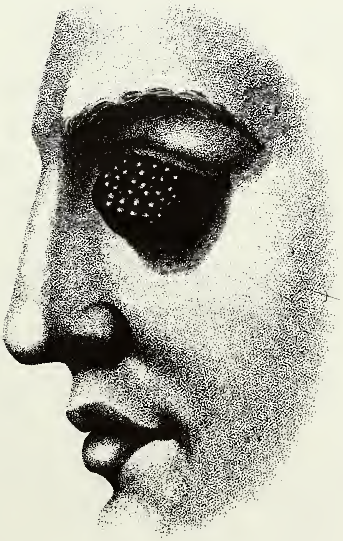

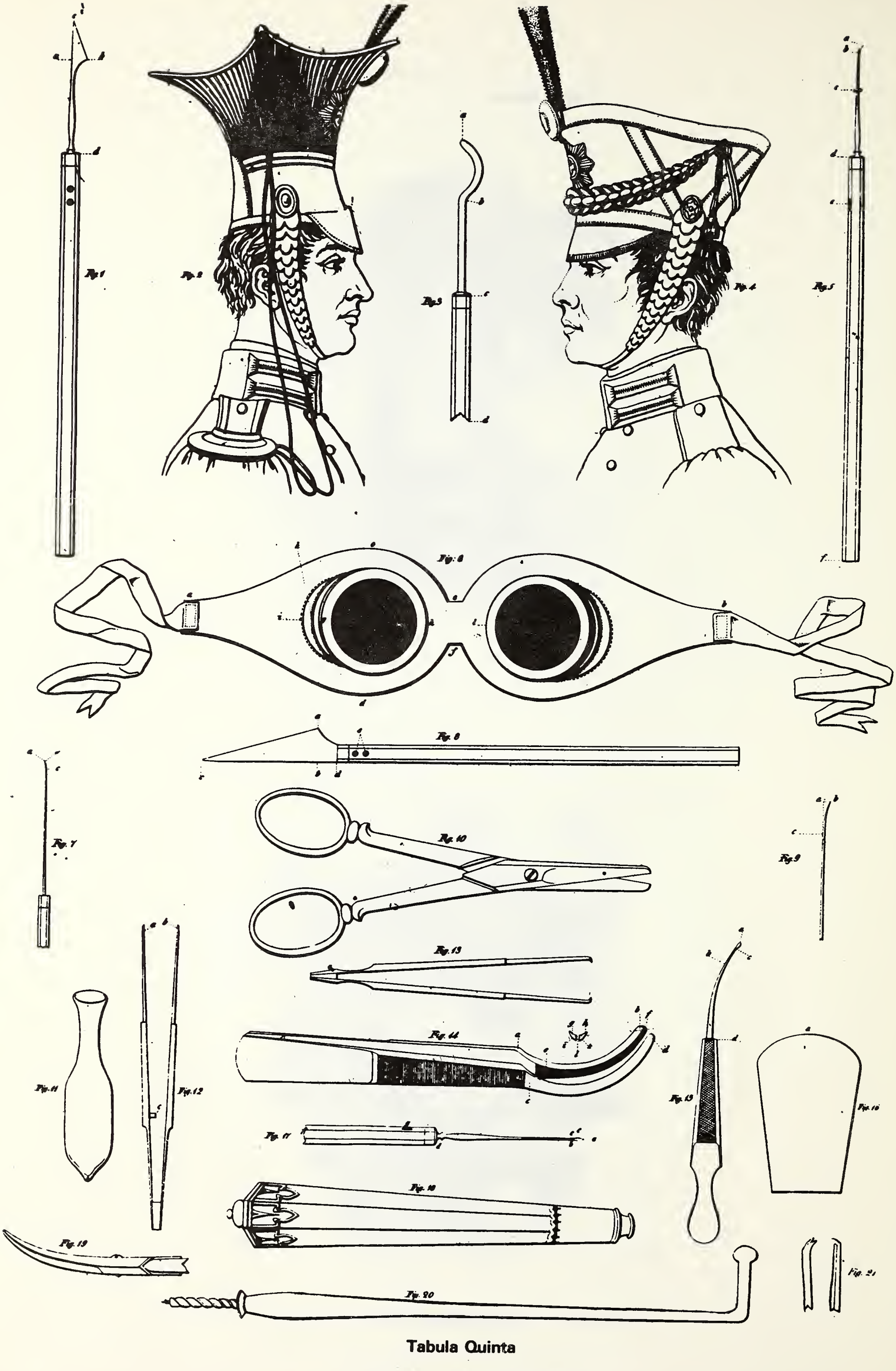

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